

*Tertiary Tipulidæ, with Special Reference to those of Florissant,
Colorado.*

By Samuel H. Scudder.

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I. INTRODUCTION.

The occasion of the present memoir is the wish to bring to public attention a portion of the remarkably preserved remains or insects at Florissant, Colorado, in a lake deposit adjudged to be of oligocene age. The locality is already famous for the extraordinary abundance and variety, as well as the excellent condition, of the insect remains therein entombed, and perhaps no group of insects shows this more strikingly than the family of "Crane-flies" or "Daddy Long-Legs."

Several hundred specimens have been collected there, and in a very considerable number of them, representing many species, as the accompanying plates* will testify, not only is the venation of the wings completely represented, with all their most delicate markings, but also the slender and fragile legs with their clothing of hairs and spurs, and to some degree, at least, the antennæ and palpi. Even the facets of the compound eye are often preserved as in life. Previous illustrations of fossil Tipulidæ have rarely represented more than the wings, and even these generally in a very insufficient manner; so that merely as illustrations of fossil remains, the present plates far surpass all that have gone before, and render the study of fossil Tipulidæ very different from our former meagre opportunities. If satisfactory illustrations could only be published

* By the cheerful permission of the Director of the U. S. Geologic Survey, I have had placed at my disposal for the illustration of this memoir the drawings of these insects made under my direction, and belonging to the Survey.

of the numerous forms of Tipulidæ recognized by Loew in Prussian amber, we should now have a far better basis for some exact knowledge of the past.

Up to the present time the only known fossil Tipulidæ from America were the few which I have published from the Green River beds in Wyoming, and the White River beds in western Colorado. In preparing the present memoir these have been subjected to a fresh study by comparison with those at Florissant, though I have not attempted to extend our knowledge of the fauna of these deposits, but have merely described the Florissant species, and introduced those known from other localities in their proper systematic position. In doing this the number of the previously described types has been reduced by two, and there remain six species of four genera of Limnobiinæ from White River, and two species of one genus of Tipulinæ from Green River. Other species are in my possession which will be published on a future occasion.

The new forms here described come, as stated, from Florissant only, and number twenty-nine species of ten genera of Limnobiinæ, and twenty-two species of five genera of Tipulinæ. No such extensive addition to tertiary Tipulidæ has been made since Loew first indicated the riches (still unpublished, after the lapse of forty-three years) of the amber fauna of Europe. If we were to compare the now described and figured tertiary species of America with the actually described or figured tertiary species of Europe (seventeen species of seven genera of Limnobiinæ, eleven species of three genera of Tipulinæ), we should find twice as many Limnobiinæ, and more than twice as many Tipulinæ; or a Tipulid fauna considerably more than twice as rich as that of Europe.

In a memoir on the *Tertiary Rhynchophorous Coleoptera of North America*, now passing through the press (Monograph xxi, U. S. Geological Survey), I have called attention to the fact that not a single one of the one hundred and sixteen species of weevils found fossil at Florissant occurs in any of the three other prolific localities of fossil insects in Colorado and Wyoming; while each of these three (Roan Mountains, in western Colorado; White River, at the boundary between Colorado and Utah; and Green River, Wyoming—which together possess seventy-five species) shares from one third to two thirds its species with one or the other of its neighbors. From these facts, and from the field evidence, I have drawn

the conclusion that the three principal insect localities in western Colorado and Wyoming are deposits in a single body of water, the ancient Gosiute Lake, as it was called by Clarence King; and in speaking of remains from these deposits as a whole, I have applied to them the term *Gosiute Fauna* in distinction from the Florissant or *Lacustrine Fauna* in central Colorado.

The result of the present studies upon the Tipulidæ also has been to show that no single species of the Lacustrine fauna occurs in the Gosiute fauna, though the paucity of remains in the latter does not give this fact the same weight as in the Rhynchophora; and it should also be mentioned that among the few genera found in two of the localities in the Gosiute fauna, the species of each locality are distinct from those of the other.

In his first extended communication on the amber Diptera, Loew called attention to the remarkable alliance of that fauna with the existing fauna of the eastern United States. He further expanded the subject in a most interesting essay, translated by Osten Sacken and published in *Silliman's Journal* for 1864. In this paper he reached the conclusion that "the amber Diptera stand in a much closer relation to the North American and to the European [*i. e.*, those now existing] than to those of any other fauna"; and he further asserts "with the utmost certainty that those among the living Diptera which most closely resemble the amber Diptera, abound in a most prevailing degree in North America and especially between the latitudes of about 32° to 40°."

Baron Osten Sacken, in numerous passages, has insisted upon the same resemblance. In the Tabular View of Tertiary Tipulidæ we have given further on, it will be seen that (omitting Tanymera as doubtful) thirteen genera are credited to the Baltic amber, of which ten are found in America, and one of them in North America only besides its occurrence in amber; this last is *Idioplasta*. On the other hand, only eight of the amber genera occur now in Europe, and all these genera have also American representatives. At the most, two genera, *Trichoneura* and *Calobamon* (and *Tanymera* also, if it is to be included), seem to be known so far only in amber, but they are all as yet imperfectly characterized. Only five of the amber genera have representatives elsewhere than in Europe or America, and one of these is cosmopolitan.

No such striking conclusions can be reached from the study of the tertiary Tipulidæ of North America, at least at present. A large

proportion of the genera are extinct (genera which include about one third of the species), and of the remainder the larger proportion are genera found in north temperate regions of both worlds. *Cladura* only (with the allied extinct *Cladoneura*) shows distinctively American affinities, and none are more nearly allied to the genera of the European fauna, whether recent or extinct, than to those of the existing American fauna.

In making a comparison between our tertiary Tipulid fauna and that of North America north of Mexico on the one hand, and the more imperfectly known fauna of the southern part of North America* on the other, the tertiary fauna distinctly appears more nearly related to the former, for the latter contains the following only: *Limnobini*, 1 sp.; *Rhamphidini*, 3 sp.; *Eriopterini*, 3 sp.; *Limnophilini*, 6 sp.; and *Anisomerini*, 7 sp., a total of twenty *Limnobinæ*; and there are besides eighteen *Tipulinæ*. The relative proportion of *Tipulinæ* is therefore much greater; while among the *Limnobinæ* the tribe *Anisomerini*, not represented at all among the fossils (and having in the United States and Canada but six per cent. of the species, if the tribes represented in Mexico and Central America alone are counted) possesses no less than thirty-five per cent. of all *Limnobinæ*, while the *Limnobini* have but five per cent. It is only in the relative numbers of the *Rhamphidini* that any nearer approach is seen between the tertiary fauna of Colorado and the present Central American fauna.

Nor, if we examine the genera separately, can we come to any different result, for while the fossils show in several instances an identity with or close affinity to those found in the United States, the only genera among them which are also represented in the Central American fauna are the widespread and prolific types, *Limnophila* (sens. lat.) and *Tipula*; and not a single other genus found in the south shows any particular affinity to the extinct forms. We are forced to conclude, therefore, that the general affinities of the fossils are with the existing fauna of the general region in which they are found. The distribution, however, of the living genera in the United States is too little known to permit any definite and decisive conclusions on this latter point.

The relative representation in species of the different groups of *Limnobinæ* and of the total number of *Limnobinæ* and *Tipulinæ* in different regions in past and present times is shown in the follow-

* As given in Baron Osten Sacken's contribution to the *Biologia Centrali-Americana*.

ing table, where they are given first in numbers and next in percentages. Osten Sacken's *Catalogue of the Diptera of North America* (1878) is taken for the living American forms, excluding the species found only south of the United States; Schiner's *Fauna Austriaca* (1864) supplies the basis for the European forms, including the species merely enumerated as well as those described by him, and thus including all Europe; while the results of the present memoir, subsequently detailed, have been taken for the remaining columns.

Comparative View of Recent and Tertiary Tipulidæ.

TRIBES.	IN NUMBERS. (Figures represent number of species.)				IN PERCENTAGES.			
	RECENT N. A.	TERTIARY N. A.	TERTIARY EUROPE.	RECENT EUROPE.	RECENT N. A.	TERTIARY N. A.	TERTIARY EUROPE.	RECENT EUROPE.
Limnobiini.....	39	13	19	86	23	38	28	35
Rhamphidini.....	12	4	8	6	7	12	12	2
Eriopterini.....	41	7	11	57	25	21	16	23
Limnophilini.....	42	4	21	57	25	12	31	23
Anisomerini.....	8	0	3	8	5	0	4	3
Amalopini.....	15	0	4	22	9	0	6	9
Cylindrotomini.....	4	6	0	7	2	18	0	3
Ptychopterini.....	6	0	1	6	3	0	1	2
					99	101	98	100
SUBFAMILIES.								
Limnobiinæ.....	167	35	67	249	62	59	68	67
Tipulinæ.....	104	24	31	122	38	41	32	33
Totals.....	271	59	98	371	100	100	100	100

This table, and especially the side representing the percentages, shows some remarkable features. The relative proportion of the two subfamilies is shown to be somewhat different on the two continents, whether past or present time is considered, but it presents striking similarities when on either continent the tertiary and present times are compared, there being in Europe scarcely the slightest variation.

But when the several elements of the Limnobiinæ are separately considered, a somewhat different state of things appears. Here, in

a distinct though not in any striking way, the table shows that as far as the relative numbers of the subordinate groups of the tertiary fauna of North America are concerned, our tertiary Tipulidæ have a closer relationship to the fauna of tertiary Europe than to that of America to-day. One disturbing element, however, is introduced in the great prominence of the *Cylindrotomini* among the fossils, due to the large numbers of the genus *Cyttaromyia*, which must be looked upon as on the whole the most striking feature of the tertiary Tipulidæ of North America.

As a summary of general results obtained from the careful study of these remains, we venture to submit the following propositions :

1. The general facies of the Tipulid fauna of our western tertiaries is American, and agrees best with the fauna of about the same latitude in America, as far as we are at present acquainted with it.

2. All the species are extinct, and though the Gosiute Lake and the ancient lacustrine basin of Florissant were but little removed from each other, and the deposits of both are presumably of oligocene age, not a single instance is known of the occurrence of the same species in the two basins. The Tipulid fauna of the Gosiute Lake, however, is as yet very little known, and it should be added that the few described species are in no instance the same at Green River, Wyo., and White River, Colo., both localities in the same ancient lake basin.

3. No species are identical with any of the few described European tertiary Tipulidæ.

4. Restricting ourselves to the Florissant basin, from the paucity of material in the Gosiute fauna, it will be noticed that a remarkable proportion of genera (eight out of fifteen) are not yet* recognized among the living, these genera including about one third of the species.

5. With one (American) exception—*Cladura*—all the existing genera which are represented in the American tertiaries are genera common to the north temperate zone of Europe and America, and are generally either confined to these regions or the vast proportion of their species are so confined. A similar climate is indicated, but this latter conclusion should be received with hesitation, since

*It should be noted here that, in his enumeration of the amber Diptera, Loew recognized four genera as extinct, of which living representatives have since been found, without mentioning those which Osten Sacken regards as *Linnophilæ*.

our knowledge of the distribution of American genera is mostly confined to the Atlantic States. There are, however, no certain indications of a warmer climate, such as have been shown from the study of other groups.

6. There are no extinct groups higher than genera, but one or two of these, such as *Cyttaromyia* and *Micrapsis*, are of a somewhat striking character.

7. The relative importance of the two subfamilies of Tipulidæ, though differing on the two continents of Europe and America both in tertiary and in recent times, was much the same, on each continent, in tertiary times as now; while in the relative preponderance of the different tribes of Limnobiinæ, our tertiary fauna shows a somewhat closer agreement with the European tertiary than with the existing American fauna. There are, however, no striking generic alliances pointing in the same direction.

The above general conclusions have been reached after as careful a study of the tertiary fauna of Europe as the literature would allow, it being unfortunately necessary to depend entirely upon published materials, most of them ancient, for any conclusions regarding the European fossils. Fortunately, the way has been lightened by occasional expressions of opinion from Baron Osten Sacken, who has personally examined not a few of them and published here and there valuable statements regarding them. Being compelled to subject all the literature of the subject to a careful scrutiny in order to obtain any proper glimpse of the known tertiary fauna of Europe, it has seemed best to publish in this connection a formal historical review of the European tertiary Tipulidæ, in order that the grounds of my general statements may be better understood.

Accordingly, in the next section of this memoir, I give such a review, following it with a summary of results in the form of an Alphabetical List of the Genera and Species; and again with a Tabular View of Tertiary Tipulidæ in general, systematically arranged; and add a note on Pretertiary Tipulidæ, before proceeding to a special and detailed systematic discussion of the American Tertiary Tipulidæ.

II. HISTORICAL ACCOUNT OF THE EUROPEAN TERTIARY TIPULIDÆ, WITH COMMENTS.

The first fossil Tipulidæ described are those mentioned by PRESL in 1822 (*Del. Prag.*), purporting to have come from amber. They

are *Tipula antiqua*, *T. protogea*, and *T. curvicornis*. They are wholly irrecognizable from the descriptions, but their size (from one to two German lines in length) plainly shows that they are at least not Tipulinæ, and probably not even Tipulidæ. They must be left wholly out of consideration, both on this account and because it is believed that Presl's specimens were really preserved in the recent gum copal and not in amber.

UNGER in 1841 (*Verh. leop.-carol. Akad. Naturf.*, xix) described and figured the following species from Radoboj, afterwards reexamined by Heer.

Rhipidia extincta. The figures given by Unger and Heer do not entirely agree in the neuration of the wings; Unger's is the better and clearer. The head is lost, so that the antennal structure cannot be determined, and Loew has pointed out (*Zeitschr. ges. Naturw.*, xxxii, 190) the failures of the neuration, and believes Heer to have been misled in his determination by Meigen's inaccurate figure of the neuration of the modern *Rhipidia maculata*. Loew regards it as probably a true *Limnobia*.

Rhipidia major. The specimen has the tip of the wing broken, and with it are lost the parts necessary to decide to which of the subfamilies of Tipulidæ it should be referred. But as the wing must have had a length of about 22 mm., it is evident that it must belong to one of the Tipulinæ, and therefore it should be referred to *Tipula* in a large sense. Heer has already so referred it under the name *Tipula ungeri*, and Giebel has followed him in generic reference. On account of its abdominal markings, however, Heer compared it to the species of *Tipula* now placed in *Pachyrhina*.

HEER, in 1849, in his classical work on the fossil insects of Oeningen and Radoboj, makes the first important addition to the then known fossil Tipulidæ. His species are all mentioned below, and all of them stated to be from Radoboj, excepting *Limnobia formosa*, for which no locality is mentioned; it is probable that this was a mere oversight, and that it also comes from the same place. None of Heer's figures, it should be said, can be depended upon for the exact neuration, as some are manifestly incorrect, and in no case do different figures of the same wing (with different enlargements) agree. It is therefore impossible, even with the aid of the text, to place them confidently.

Tipula maculipennis. The neuration shown in Fig. 1^b differs from that in Fig. 1, the latter being undoubtedly the more correct,

as the description also shows. The markings are said to be the same as in the living *T. hortensis* of Europe. In all probability it is a true *Tipula*, and appears to fall nearest to *T. limi* or perhaps *T. carolinæ* from Florissant.

Tipula æmula. The veins are differently shown for the same wing in Figs. 2 and 2^b, the latter undoubtedly the more correct, but both wrong. As Heer says, it is closely allied to the preceding species; it is probably a true *Tipula*, and may fall near *T. heilprin* from Florissant.

Tipula varia. This species, according to Heer, belongs near the modern *T. hortensis* and *T. hortulana* of Europe. It appears to be a true *Tipula*, but the figures all vary in the neuration, with a notable difference in those of the two specimens in the length of the petiole of the second posterior cell, if the enlarged figure, 3^b, is correct in this particular, as it undoubtedly is in the other points where it varies from Fig. 3^a. It appears to come in the vicinity of *T. carolinæ*.

Tipula lineata. Here again the neuration of the enlarged figure, 4^b, differs, in the discal cell and elsewhere, from that of the figure of natural size, 4; the former is undoubtedly the more correct. It appears to be a true *Tipula*, and is said by Heer to stand next the European *T. obsoleta*. To judge from the length of the præfurca, it would seem to come nearest to *T. tartari* of any of the American tertiary species, but it is very different from it. Capellini credits this species to tertiary deposits at Gabbro, Italy.

Tipula obtecta. Here, too, the two figures differ, though but slightly, an omission in the smaller being supplied in the larger. There is no reason to suppose it is not a true *Tipula*, and it is regarded by Heer as near his *T. varia* from the same beds. It apparently belongs with the series having a relatively short præfurca and seems to come nearest to our *T. subterjacens*.

Tipula ungeri. This is the species mentioned above as originally described by Unger under the name *Rhipidia major*. Heer shows that it should be referred to *Tipula*, but there seems to have been no real occasion to change the specific name. Giebel held this view and described it as *Tipula major*.

Rhipidia extincta. See above under the same species described by Unger.

Rhipidia picta and *R. propinquans*. Loew's criticisms apply equally well to these two species, which there is every reason to place

in the same genus as *R. extincta*. They may therefore be referred to *Limnobia*.

Limnobia formosa. Here Heer's two figures essentially agree and are very good. Heer compares it to two living European species, *L. quadrinotata* and *L. annulus*, both true *Limnobiæ*, and if the neuration is correctly given, it is plain from the length of the auxiliary that it is a *Limnobia*, and not a *Dicranomyia*. This is the species, presumably from Radoboj, the locality of which is not stated by Heer.

Limnobia cingulata. The two figures given by Heer disagree in important particulars, and that which is enlarged is plainly incorrect. Heer states that it agrees so closely with *L. nubeculosa* Meig. as hardly to be distinguished from it, and he specifies in particular the neuration. It is therefore probably a true *Limnobia*.

Limnobia tenuis. The neuration is only partially shown, and is said by Heer to be difficult to trace. Heer compares it to that of *L. lutea* Meig., a true *Limnobia*, and there is nothing in what is figured inconsistent with such a generic reference.

Limnobia vetusta. Two different figures of this are given by Heer, one of them useless, the other none too good, but showing the coarser parts of the neuration, from which it would appear to be a *Limnobia*. Heer compares it to *L. dumetorum* Linn., a true *Limnobia*. There is an additional figure of this species in Heer's *Fossile Hymenopteren*, Pl. iii, fig. 15c, overlooked in my *Index to Described Fossil Insects*; it is too small to be of any service, the neuration being only vaguely indicated.

Limnobia debilis. The venation given in the two figures by Heer does not agree, and the smaller figure is manifestly incorrect in this particular; besides Heer specifies that the larger figure is to be used for studying the venation. This shows that it is no *Limnobia* in the present sense. Heer, himself, says that the neuration agrees with that of *L. sylvatica* Meig., which Schiner refers to *Gnophomyia*, and as the neuration of the enlarged figure shows nothing discordant with *Gnophomyia*, it may best be referred here until re-examination of the type can be had.

The only other Tipulids to be credited to Heer are one given in his *Urwelt der Schweiz* (1865), coming from the miocene of Locle, Switzerland, and another from Aix, in his account of the Aix fossil insects (1856).

Limnobia jaccardi. This species from Locle is not described, but

a clear figure of a complete wing is given. This shows some manifest inaccuracies, as in the origin of the fifth and sixth longitudinal veins, and a cross vein beyond the origin of the præfurca, uniting the first longitudinal vein and the costa and running *across* the auxiliary. A cross vein is also shown at about the middle of the second submarginal cell, which is probably misplaced. As there are plainly two submarginal cells, it is clearly not a *Limnobia*. If we interpret the cross vein beyond the origin of the præfurca as the subcostal cross vein (wrongly carried across to the costa), the parallel cross mark midway between it and the tip as the termination of the auxiliary (wrongly connected with the first longitudinal vein), and carry the misplaced cross vein in the second submarginal cell to the bend in the first longitudinal vein just beyond the base of the first submarginal cell, where a marginal cross vein would naturally occur, we have the essential characteristics of the neurulation of *Trichocera*, and these manifest inaccuracies aside there is no other genus with which it agrees so well. Moreover, Loew indicates two fossil species of this genus from amber (without describing or naming them), so that the occurrence of the genus in Europe at the period when this insect flourished is certain.

Limnobia purchisoni from Aix. Heer's figure is plainly copied from that of Curtis, who figured but did not describe it (1829), but he describes from the original specimen, and compares it to the living *L. annulus* Meig., with which the neurulation is said to correspond. The figure is good, but the auxiliary vein does not appear. There is nothing to show that it is not a true *Limnobia*, though it is possibly a *Dicranomyia*. Probably an examination of the fossil would determine. Heer's paper naming this species appeared in the same year (1856) as Giebel's volume applying to it the name *Limnobia curtisi*. As priority cannot be proved for either, it seems proper to prefer Heer's name, since he evidently studied the specimen itself.

In 1850, LOEW, in his *Meseritz Programm*, gave the first important communication on amber Diptera, mentioning a large number of species (undescribed) under many new generic names; most of these are regarded by Osten Sacken, as appears by numerous references by him, to be identical with existing genera, and especially with *Limnophila*, a genus which he considers as not yet properly subject to division into more than subgenera. The genera given by Loew were in some cases named by him in a list appended

to the introduction to Berendt's folio work on the amber fauna (1845), but one, *Adetus*, mentioned then by him does not appear later, and was evidently dropped by Loew; whether it was regarded as not separable from *Tipula*, next to which it stands in the list, or as equivalent to one of the numerous genera of *Limnobiinæ* afterwards proposed, does not appear. These genera were not fully described by Loew in his *Meseritz Programm*, but merely separated from one another in a table prepared to show their relationships. They were as follows, the new ones prefixed by an asterisk; none of the species were named.

Tipula. Of this genus he names three species and records thirteen others.

Rhamphidia. Two species named and two others recorded.

* *Toxorhina*. Three species are named. The following year (*Linn. ent.*, v) they were partially described, especially the palpi which were also figured, and the genus described, but the characters of the genus were almost entirely based on a living species from the West Indies, which it has since been shown should be generically dissociated from them. Osten Sacken has since retained the name *Toxorhina* for the West Indian species, and referred the fossils at first to the existing genus *Limnobiorhynchus*, and (when it was found that this was based on incongruous material, the sexes of different genera already known) to the genus *Elephantomyia*, which also contains living representatives. Osten Sacken objects to Schiner's contention that the name *Toxorhina* should be primarily restricted to the fossil species, and mainly on the ground that though when first proposed only amber species were included in it, it was not characterized until the following year, and then on structures drawn from a living insect, which in part did not exist in the fossil. I regret to differ at all from Baron Osten Sacken—the foremost student of the group of Diptera—but it cannot be fairly claimed that *Toxorhina* was not characterized when first proposed, for not only does his mention of the genus include the statement that it has an extraordinarily long filiform rostrum, and exceptionally short four-jointed palpi, but the table on the preceding page, wherein the genera are differentiated (a table to which Osten Sacken appears to have paid no attention), practically defines the genus thus: Rostrum slender, longer than head and prothorax together. Palpi short, the last joint not so long as or scarcely longer than those which precede, taken together. This, though not all that could be

asked, is assuredly not to be ignored, and I have accordingly here retained the name *Toxorhina* for the fossil species, and *Toxorhina fragilis* of the West Indies—the bone of all this contention—should be known under some other generic name.

* *Macrochile*. One named species. The name, being found to be preoccupied, has been changed by Osten Sacken to *Idioplasta*. Living species are now known.

Cylindrotoma. Four named species. These have been studied by Osten Sacken, and regarded by him as belonging to *Limnophila* in a narrow sense, excepting *C. longicornis*, which he places in the subgenus *Lasiomastix*.

Trichocera. Two unnamed species.

Anisomera. One named species; it is regarded by Osten Sacken as an *Eriocera*.

Erioptera. Eight unnamed species.

* *Trichoneura*. One named and three unnamed species. According to Osten Sacken these belong to the division of *Limnophila* with four posterior cells.

* *Calobamon*. One unnamed species. Osten Sacken reproduces Loew's description of the genus, with additions of his own from examination of the type (*Berl. ent. Zeitschr.*, xxxi, 207). He gives no opinion of it other than to mention its "apparent relationship to the *Limnophilina*."

* *Haploneura*. Four unnamed species. Osten Sacken subsequently mentions one species by Loew's manuscript name, *H. hirtipennis*, which, he says, belongs to *Ula*. Probably the others also belong there.

* *Critoneura*. Two named species, regarded by Osten Sacken as belonging to *Limnophila*.

* *Tanymera*. Four unnamed species, one of which is afterwards specified by Osten Sacken by Loew's manuscript name, *T. gracilicornis*, which, he says, is a *Limnophila*; but he makes no statement regarding the others.

* *Tanysphyra*. One named species, called a *Limnophila* by Osten Sacken.

* *Styringomyia*. One named species, recognized by Osten Sacken as correctly placed. The genus has since been found living and also in copal.

* *Ataracta*. Eight unnamed species. Osten Sacken says this generic name is equivalent to *Dicranomyia*.

* *Allarithmia*. One named species, regarded by Osten Sacken as an Eriocera, of which, he says, he has recognized three species in Prussian amber, one other being the *Anisomera* mentioned above.

From this it would appear that the amber fauna does not contain a single extinct generic type, unless *Calobamon* be excepted, although several of the genera were first made known from amber.

In connection with the amber Diptera, it may be added that Burmeister, in his *Manual of Entomology* (1836), mentions several species of "*Limnobia*" found in amber, some small like *L. pulchella* (now referred to *Idioptera*, a subgenus of *Limnophila*), some larger. Of course, any nearer reference is impossible. So too several other authors—Defrance, Schlotheim, Sendel, etc.—have mentioned the occurrence in amber of species of "*Tipula*", but Loew's later and fuller statements are presumed to cover all these.

GUÉRIN (*Rev. Zool.*, 1838, 170, pl. i, fig. 18) mentions "deux petits Tipulaires en état d'accouplement" in Sicilian amber. In my *Index to Described Fossil Insects*, p. 667, I have wrongly quoted this as "*Tipula*," as no genus is specified, and it is evident from the figure that the insect is rather one of the *Mycetophilidæ*.

AYMARD, in 1854, catalogues two named but undescribed species of a genus he calls *Dichaneurum*, without further indication of its characters than that it belongs to the family *Tipulidæ*, as found fossil at Le Puy, France. The reference is of course valueless without further details.

GIEBEL, in his *Fauna der Vorwelt* (1856), describes anew, so far as possible, all the then known fossil *Tipulidæ*, and adds descriptions of two new forms from amber found in the collection of the Leipzig Museum. Concerning Giebel's *Tipula major* and *Limnobia curtisi*, see above under Heer's species *Tipula ungeri* and *Limnobia purchisoni*. The new species are the following:

Limnobia furcata. Giebel states that in regard to its neuration this species belongs to the group containing *L. fulvescens*, *ferruginea*, *bicolor*, etc., *i. e.*, to that now classed as *Limnophila*. The description agrees entirely with *Limnophila*. Giebel may easily have overlooked the tibial spurs of which he makes no mention. There are no means of determining whether it be not one of the numerous *Limnophilini* mentioned by Loew.

Limnobia deleta. The single specimen has the wings damaged

“so that a closer comparison with living species is not possible.” The antennæ are described as fifteen-jointed and twice as long as the body, with equal cylindrical joints; the halteres are nearly as long as the abdomen; the wings have the first longitudinal vein (schulterader) rather distant from the auxiliary (randader), with which it is connected by the subcostal cross vein before the middle of the wing. From this brief description it is impossible to tell where it belongs, but the fifteen-jointed antennæ point to the Limnobini.

In 1859 and 1870, HEYDEN described in the *Palæontographica* the following species, all from Rott in Rhenish Prussia.

Ctenophora decheni. Both the form of the abdomen and the character of the antennæ show it to be a male. Heyden says the neuration shows little variation from that of living species of *Ctenophora*. But his delineation of the same is like no *Ctenophora* and manifestly incorrect, affording no clew to the affinities which a correct sketch might offer. The stout legs show that it cannot be a *Tipula*, and the apparently pectinate antennæ suggest a possible alliance to South American forms like *Ctedonia* and *Ozodicera*. The specimens should be restudied, but in the meantime be retained in *Ctenophora*.

Erioptera danæ. The wings are not preserved, or only along the costal margin. By the short middle femora, the spurless tibiæ, and the small size, it was referred by Heyden to *Erioptera*. It would probably not be possible to place it more definitely. The male appendages also agree fairly.

Limnobia sturi. The two figures of the same wing do not agree, but the differences are slight, and the description shows the enlarged figure to be the more correct, as indeed the left wing (not enlarged) shows. It is plain from the neuration that the insect is not a *Limnobia* in its present sense, but a *Gonomyia*, and not very far removed from *G. profundi* from Florissant.

NOVÁK, in 1877, published an account of the fossil insects of Krottensee, Bohemia, in the *Sitzungsberichte* of the Vienna academy. Among them were the following *Tipulidæ*:

Tipula angustata. This species closely resembles *T. sepulchri* from Florissant, but the latter is nearly twice as large. This Krottensee species is the smallest fossil *Tipula* known.

Tipula expectans. This species has a very long præfurca. It

appears to be a *Tipula* so far as can be told from the wing alone. From its long præfurca it seems to be most nearly allied to the spotted *T. tartari* of Florissant, but it differs in the length of the petiole of the second posterior cell, and in the narrowness of the wing.

Ptychoptera deleta. The figure of this species is excellent, showing the species to be certainly nearer to *Ptychoptera* than to any known genus, though the number of posterior cells cannot be determined from the imperfection of the specimen. It certainly must belong to the *Ptychopterini*, but shows some peculiarities worthy of special notice. Thus in *Ptychoptera* (at least in the American species—and Osten Sacken says that the two European species seen by him do not materially differ from it) the first longitudinal vein appears to end in the costa, and to be connected with the uppermost branch of the second by a marginal cross vein, while in the fossil it ends in the second longitudinal vein at the point where the marginal cross vein would occur did it exist. And there is further a costal cross vein uniting the auxiliary vein to the costa in the middle of the wing. Novák's description as well as figure attest these points and indicate a peculiar genus.

OMBONI, in 1886, in a brief account of some Italian fossil insects (*Atti r. ist. Veneto*, (6), iv) describes and figures the following from the miocene of Chiavon.

Tipula zignoi. The figure of this fossil is utterly worthless, gives no sort of clew to its relationship, and would seem to show that the fossil itself is irrecoznizable. Omboni indeed says it would be "difficult, not to say impossible," definitely to refer it, and adds that it has no trace of wings, and is probably a *Chironomus*, a *Tipula*, or a *Limnobia*. Its size alone quite precludes reference to *Tipula*, and it may well be left to oblivion.

FOERSTER, in an elaborate account of the fossil insects found in the middle oligocene of Brunstatt (*Abh. Specialk. Elsass-Lothr.*, iii, 1891) mentions, without naming, the following two species of *Tipulidæ*.

Tipula sp. 1. This species evidently belongs to our new genus *Tipulidea*, the length of the præfurca just equaling, or certainly not surpassing, the greatest breadth of the first basal cell. It differs, however, from any of the American species, but seems most nearly allied to *T. picta*.

Tipula sp. 2. This, too, belongs to *Tipulidea*, and resembles the

preceding species more nearly than it does any of the American forms. Both European species have a smaller second posterior cell than any of ours, and the length and slenderness of the fourth posterior cell is much greater.

Finally, to specify a few minor instances of little present value, SERRES (*Géogn. terr. tert.*, 1829) states that a fossil fly of the genus *Nephrotoma*, allied to the European *N. dorsalis*, occurs in the beds at Aix, Provence, and credits to the same beds a species of *Trichocera*.—HOPE mentions a *Tipula* from Aix (*Trans. Entom. Soc. Lond.*, iv, 253, 1847) which he compares with *T. rivosa*. I do not know what that species may be. HEER has also named a species from the same place, *Tipula infernalis*, but it is undescribed.—WOODWARD, in a list of insect remains from the Isle of Wight (*Quart. Journ. Geol. Soc. Lond.*, xxxv, 344, 1879) gives among others “*Tipulidæ*, 6” specimens.—SCHÖBERLIN (*Soc. Entom.*, iii, 69, 1888) mentions the occurrence of a species of *Tipula* at Oeningen, Baden, which he compares to *T. ochracea*, a true *Tipula*.—BELL, in the *Entomologist* (xxi, 1888) in an article on glacial insects, mentions a “*Dicæra*, allied to *Tipula*,” as found in a “crannoge” in Wigtonshire, England, presumably in the refuse of lake-dwellings. Apparently he must have meant something akin to *Dictenidea* or *Ctenophora*, but closer reference is impossible; it is perhaps hardly fair to class it at all among fossil insects, and it is accordingly not alluded to in the tabular lists in this paper.—Lastly, KLEBS, in his *Catalogue of the Stantien and Becker bernstein-museum* (1889), on p. 65, lists a specimen (No. 478) “in the vicinity of *Tipula*, a new species with striking antennæ.”

These data are all summarized in the following list, in which the species which are known purely by name, without description or figure, are prefixed by an asterisk.

III. ALPHABETICAL LIST OF EUROPEAN TERTIARY TIPULIDÆ, WITH THEIR PROBABLE SYSTEMATIC POSITION.

- * *Adetus* 1 sp. Loew, amber. Indeterminable.
- * *Allarithmia palpata* Loew, amber. *Eriocera*.
- * *Anisomera succini* Loew, amber. *Eriocera*.
- * *Ataracta* 8 sp. Loew, amber. *Dicranomyia*.
- * *Calobamon* 1 sp. Loew, amber. *Calobamon*.
- * *Critoneura longipes* Loew, amber. *Limnophila*.

- * *Critoneura pentagonalis* Loew, amber. *Limnophila*.
Ctenophora decheni Heyden, Rott. *Ctenophora*.
- * " I sp. Foerster, Brunstatt (afterwards described as *Tipula*, q. v.)
- * *Cylindrotoma brevicornis* Loew, amber. *Limnophila*.
- * " *longicornis* " " "
- * " *longipes* " " "
- * " *succini* " " "
- * *Dichaneurum infossum* Aymard, Le Puy. Indeterminable.
- * " *primævum* " " "
- Elephantomyia brevipalpa* Osten Sacken, amber. *Toxorhina*.
 " *longirostris* " " "
 " *pulchella* " " "
- * *Eriocera palpata* Osten Sacken, amber. *Eriocera*.
- * " *succini* " " "
- * " I sp. " " "
- Erioptera danæ* Heyden, Rott. *Erioptera*.
- * *Erioptera* 8 sp. Loew, amber. "
- * *Geranomyia* 1 sp. Osten Sacken, Aix. *Geranomyia*.
- * *Haploneura hirtipennis* Loew, amber. *Ula*.
- * " 3 sp. " " "
- * *Idioplasta spectrum* Osten Sacken, amber. *Idioplasta*.
- Limnobia cingulata* Heer, Radoboj. *Limnobia*.
 " *curtisi* Giebel, Aix (= *L. murchisoni*). *Limnobia*.
 " *debilis* Heer, Radoboj. *Gnophomyia*.
 " *deleta* Giebel, amber. *Limnobia*.
 " *extincta* Loew, Radoboj. "
 " *formosa* Heer, Radoboj? "
 " *furcata* Giebel, amber. *Limnophila*.
 " *jaccardi* Heer, Locle. *Trichocera*.
 " *murchisoni* Heer, Aix. *Limnobia*.
 " *picta* Loew, Radoboj. "
 " *propinqua* Loew, Radoboj. "
 " *sturi* Heyden, Rott. *Gonomyia*.
 " *tenuis* Heer, Radoboj. *Limnobia*.
 " *vetusta* " " "
- * " sev. sp. Burmeister, amber. "
- Limnobiorhynchus brevipalpus* Osten Sacken, amber. *Toxorhina*.
 " *longirostris* " " "
 " *pulchellus* " " "
- * *Limnophila brevicornis* Osten Sacken, amber. *Limnophila*.
 * " *gracilicornis* " " "
 * " *gracilis* " " "
 * " *longicornis* " " "
 * " *longipes* (1) " " "
 * " " (2) " " "
 * " *pentagonalis* " " "

- * *Limnophila succini* Osten Sacken, amber. *Limnophila*.
 * " *vulgaris* " " "
 * *Macrochile spectrum* Loew, amber. *Idioplasta*.
 * *Nephrotoma* 1 sp. Serres, Aix. *Nephrotoma* ?
Ptychoptera deleta Novák, Krottensee. *Ptychoptera* ?
 * *Rhamphidia minuta* Loew, amber. *Rhamphidia*.
 * " *pulchra* " " "
 * " 2 sp. " " "
Rhipidia extincta Unger, Radoboj. *Limnobia*.
 " *major* " " *Tipula*.
 " *picta* Heer, " *Limnobia*.
 " *propinqua* Heer, " "
 * *Styringomyia gracilis* Loew, amber. *Styringomyia*.
 * *Tanymera gracilicornis* Loew, amber. *Limnophila*.
 * " 3 sp. Loew, amber. *Tanymera* ?
 * *Tanysphyra gracilis* Loew, amber. *Limnophila*.
 * *Tipula* sp. vic. *T. ochracea* Schöberlin, Oeningen. *Tipula*.
 * " " " *T. pratensis* Burmeister, amber. "
 * " " " *T. rivosa* Hope, Aix. "
 " " 1 Foerster, Brunstatt. *Tipulidea*.
 " " 2 " " "
 " *æmula* Heer, Radoboj. *Tipula*.
 " *angustata* Novák, Krottensee. *Tipula*.
 " *antiqua* Presl, amber (?). Indeterminable.
 * " *brevirostris* Loew, amber. *Tipula*.
 " *curvirostris* Presl, amber (?). Indeterminable.
 * " *eucera* Loew, amber. *Tipula*.
 " *expectans* Novák, Krottensee. *Tipula*.
 * " *goliath* Loew, amber. "
 * " *infernalis* Heer, Aix. "
 " *lineata* " Radoboj. "
 " *maculipennis* Heer, Radoboj. "
 " *major* Giebel, " "
 " *obtecta* Heer, " "
 " *protogæa* Presl, amber (?). Indeterminable.
 " *ungeri* Heer, Radoboj (= *T. major*). *Tipula*.
 " *varia* " " "
 " *zignoi* Omboni, Chiavon. Irrecognizable.
Toxorhina brevipalpa Loew, amber. *Toxorhina*.
 " *longirostris* " " "
 " *pulchella* " " "
 * *Trichocera* 1 sp. Serres, Aix. *Trichocera* ?
 * " 2 sp. Loew, amber. "
 * *Trichoneura vulgaris* Loew, amber. *Limnophila*.
 * " 3 sp. " " *Trichoneura* ?

IV. TABULAR VIEW OF TERTIARY TIPULIDÆ, SYSTEMATICALLY
 ARRANGED.

 (*Species known by name only are prefixed with an asterisk.*)

LIST OF SPECIES.	NORTH AMERICAN.	EUROPEAN.
Limnobiini.		
* <i>Dicranomyia</i> 8 sp. (Loew),.....	.....	Prussian amber.
" <i>longipes</i> Scudd.....	Florissant, Colo.	
" <i>stagnorum</i> "	" "	
" <i>inferna</i> "	" "	
" <i>fragilis</i> "	" "	
" <i>stigmosa</i> "	White River, Colo.	
" <i>primitiva</i> "	" "	
" <i>fontainei</i> "	Florissant, Colo.	
" <i>rostrata</i> "	White River, Colo.	
<i>Spiladomyia simplex</i> "	" "	
* <i>Geranomyia</i> 1 sp. (Osten Sacken)...	.....	Aix, Provence.
* <i>Limnobia</i> sev. sp. (Burmeister).....	.....	Prussian amber.
" <i>cingulata</i> Heer.....	.....	Radoboj, Croatia.
" <i>deleta</i> Giebel.....	.....	Prussian amber.
" <i>extincta</i> (Unger) Loew.....	.....	Radoboj, Croatia.
" <i>formosa</i> Heer.....	.....	" " (?)
" <i>murchisoni</i> Heer.....	.....	Aix, Provence.
" <i>picta</i> (Heer) Loew.....	.....	Radoboj, Croatia.
" <i>propinqua</i> (Heer) Heyden.....	.....	Rott on the Rhine.
" <i>tenuis</i> Heer.....	.....	Radoboj, Croatia.
" <i>vetusta</i> Heer.....	.....	" "
<i>Limnocema marcescens</i> Scudd.....	Florissant, Colo.	
" <i>lutescens</i> "	" "	
" <i>styx</i> "	" "	
" <i>mortoni</i> "	" "	
Rhamphidini.		
<i>Rhamphidia saxetana</i> Scudd.....	" "	
" <i>fecaria</i> "	" "	
" <i>loewi</i> "	" "	
* " <i>minuta</i> Loew.....	.....	Prussian amber.
* " <i>pulchra</i> " .....	.....	" "
* " 2 other species (Loew) .....	.....	" "
* <i>Styringomyia</i> 1 sp. (Loew).....	.....	" "
<i>Toxorhina brevipalpa</i> Loew.....	.....	" "
" <i>longirostris</i> " .....	.....	" "
" <i>pulchella</i> " .....	.....	" "
<i>Antocha principialis</i> Scudd.....	Florissant, Colo.	
Eriopterini.		
* <i>Erioptera</i> 8 sp. (Loew).....	.....	Prussian amber.
<i>Erioptera danæ</i> Heyden.....	.....	Rott on the Rhine.

LIST OF SPECIES.	NORTH AMERICAN.	EUROPEAN.
Eriopterini (<i>continued</i>).		
Gnophomyia debilis (Heer) Scudd..	.....	Radoboj, Croatia.
Gonomyia profundi	Florissant, Colo.	
“ labefactata	“ “	
“ primogenitalis	“ “	
“ frigida	“ “	
“ sturi (Heyden) Scudd....	.....	Rott on the Rhine.
Cladoneura willistoni Scudd.....	Florissant, Colo.	
Cladura maculata	“ “	
“ integra	“ “	
Limnophilini.		
Limnophila rogersii Scudd.....	“ “	
“ vasta	“ “	
“ strigosa	“ “	
“ ruinarum	“ “	
* “ brevicornis (Loew) Os-		
ten Sacken.....	.....	Prussian amber.
Limnophila furcata (Gieb.) Scudd.	.....	“ “
* “ gracilicornis (Loew)		
Osten Sacken.....	.....	“ “
* Limnophila gracilis (Loew) Osten		
Sacken.....	.....	“ “
* Limnophila (Lasiomastix) longicornis (Loew) Osten Sacken.....	.....	“ “
* Limnophila longipes (1) (Loew)		
Osten Sacken.....	.....	“ “
* Limnophila longipes (2) (Loew)		
Osten Sacken.....	.....	“ “
* Limnophila pentagonalis (Loew)		
Osten Sacken.....	.....	“ “
* Limnophila succini (Loew) Osten		
Sacken.....	.....	“ “
* Limnophila vulgaris (Loew) Osten		
Sacken.....	.....	“ “
* Trichocera 1 sp. (Serres).....	.....	Aix, Provence.
* “ ? 2 sp. (Loew).....	.....	Prussian amber.
“ jaccardi (Heer) Scudd.	.....	Locle, Switzerland.
* Tanymera ? 3 sp. (Loew).....	.....	Prussian amber.
* Trichoneura ? 3 sp. “.....	.....	“ “
* Calobamon 1 sp. “.....	.....	“ “
Anisomerini.		
* Eriocera palpata (Loew) Osten		
Sacken.....	.....	“ “

LIST OF SPECIES.	NORTH AMERICAN.	EUROPEAN.
Anisomerini (<i>continued</i>).		
* <i>Eriocera succini</i> (Loew) Osten Sacken	.....	Prussian amber.
* <i>Eriocera</i> 1 other sp. (Osten Sacken)	.....	“ “
Amalopini.		
* <i>Ula hirtipennis</i> (Loew) Osten Sacken	.....	“ “
* “ ? 3 other sp. “ “	.....	“ “
Cylindrotomini.		
<i>Cyrtaromyia fenestrata</i> Scudd.	White River, Colo.	
“ <i>princetoniana</i> Scudd.	Florissant, “	
“ <i>oligocena</i> “ ..	“ “	
“ <i>cancellata</i> “ ..	“ “	
“ <i>clathrata</i> “ ..	“ “	
<i>Oryctogma sackenii</i> “ ..	“ “	
Ptychopterini.		
* <i>Idioplasta spectrum</i> (Loew) Osten Sacken	.....	Prussian amber.
<i>Ptychoptera deleta</i> Novák	.....	Krottensee, Bohemia
<i>Pronophlebia rediviva</i> Scudd.	White River, Colo.	
Tipulinæ.		
<i>Manapsis anomala</i> Scudd.	Florissant, Colo.	
<i>Rhadinobrochus extinctus</i> Scudd.	“ “	
<i>Tipula magnifica</i> “ ..	“ “	
“ <i>rigens</i> “ ..	“ “	
“ <i>florissanta</i> “ ..	“ “	
“ <i>clauda</i> “ ..	“ “	
“ <i>sepulchri</i> “ ..	Green River, Wyo.	
“ <i>angustata</i> Novák	.....	Krottensee, Bohemia
“ <i>revivificata</i> Scudd.	Florissant, Colo.	
“ <i>evanitura</i> “ ..	“ “	
“ <i>maclurei</i> “ ..	“ “	
“ <i>heilprini</i> “ ..	“ “	
“ <i>æmula</i> Heer	.....	Radoboj, Croatia.
“ <i>tartari</i> Scudd.	Florissant, Colo.	
“ <i>expectans</i> Novák	.....	Krottensee, Bohemia
“ <i>lineata</i> Heer	.....	Radoboj, Croatia.
“ <i>carolinæ</i> Scudd.	Florissant, Colo.	
“ <i>varia</i> Heer	.....	Radoboj, Croatia.
“ <i>maculipennis</i> Heer	.....	“ “
“ <i>limi</i> Scudd.	Florissant, Colo.	
“ <i>internecata</i> Scudd.	“ “	
“ <i>subterjacens</i> “ ..	“ “	

LIST OF SPECIES.	NORTH AMERICAN.	EUROPEAN.
Tipulinæ (continued).		
Tipula obtecta Heer.....	.....	Radoboj, Croatia.
“ lethæa Scudd.....	Florissant, Colo.	
“ lapillescens Scudd.....	“ “	
“ spoliata “.....	Green River, Wyo.	
* “ brevisrostris Loew.....	.....	Prussian amber.
* “ eucera “.....	.....	“ “
* “ goliath “.....	.....	“ “
* “ infernalis Heer.....	.....	Aix, Provence.
“ ? major (Unger) Giebel.....	.....	Radoboj, Croatia.
* “ sp. vic. T. pratensis (Burm.).....	.....	Prussian amber.
* “ “ “ T. rivosâ (Hope).....	.....	Aix, Provence.
* “ “ “ T. ochracea (Schöberlin).....	.....	Oeningen, Baden.
* Tipula 9 other sp. (Loew).....	.....	Prussian amber.
Tipulidea consumpta Scudd.....	Florissant, Colo.	
“ bilineata “.....	“ “	
“ picta “.....	“ “	
“ reliquiæ “.....	“ “	
“ (“sp. 1” Foerster) Scudd.....	.....	Brunstatt, Alsatia.
“ (“sp. 2” “ ) “.....	.....	“ “
* Nephrotoma ? sp. (Serres).....	.....	Aix, Provence.
Ctenophora decheni Heyden.....	.....	Rott on the Rhine.
Micrapsis paludis Scudd.....	Florissant, Colo.	

V. NOTE ON PRETERTIARY TIPULIDÆ.

The allusions in literature to pretertiary Tipulidæ are all from the mesozoic, and all somewhat unsatisfactory, most of them vague and entirely uncertain. All but two are from Great Britain, and these may be first considered.

The earliest reference is in a paper by Buckman (*Proc. Geol. Soc. Lond.*, iv, 212, 1843), in which he merely refers to a wing found in the upper Lias at Dumbleton, as “supposed to belong to Tipula.”

A couple of years later, Murchison, in the second edition of the *Geology of Cheltenham*, figures (Pl. viii, fig. 3) the wing of an insect, of which nothing is said in the text, except in the explanation of the plate, which reads, “Wing (perhaps) of Tipula.” On p. 82 it is stated that the insects figured on this plate are “principally” from the lower Lias, which is the only indication of its horizon or locality.

The wing may easily be one of the Tipulinæ, but is too poorly engraved to be certain, and it looks just as much like one of the Neuroptera common in the British Lias. Only examination of the specimen can possibly determine it.

In the same year Brodie, in his *Fossil Insects*, gives in one of the lists of fossils from Purbeck strata: "Tipulidæ; there are several unfigured specimens which belong to this family"; further details are lacking. "Tipulidæ" is given in a similar list in his *Distr. Correl. Foss. Ins.*, p. 15 (1873), while on p. 17 of the same is listed a "Tipula" from the lower Lias of Strensham.

In 1854, Westwood (*Quart. Journ. Geol. Soc. Lond.*, x) makes three references to Tipulidæ. One, which is figured on Pl. xv, fig. 1, is merely an abdomen marked "Tipulideous." It is also mentioned on p. 386, and briefly described later by Giebel (*Ins. d. Vorw.*, 242) as a Tipula. By accident it has been twice inserted in my *Index to Described Fossil Insects* as Nos. 1625 and 1666.

A second from the same place is briefly mentioned (pp. 387, 390) as the "wing of a Tipulideous insect," and is figured on the same plate (fig. 2), in the explanation to which it is named *Corethrium pertinax*. This is described by Giebel under the same name. The name will indicate the wide range then given by Westwood to the term Tipulidæ. I have reproduced this figure in Zittel's *Handbuch der Palæontologie* (fig. 1082), placing it under the Chironomidæ, but it now seems to me that it may equally, if not more probably, be referred to the Limnobiinæ. The original would repay study.

A third form is figured by Westwood (Pl. xviii, fig. 20) and briefly mentioned as the "wing of a Tipulideous insect" (p. 390) from the Purbecks of Durdlestone Bay. This, however, is certainly not one of the Tipulidæ, but more probably one of the Rhyphidæ or possibly Bibionidæ; a careful study of the original should be sufficient to decide in this case.

The only other English reference I find is the statement by Theobald (*Brit. Flies*, p. 4, 1891) that he has found in the Wealden a specimen belonging to the Tipulidæ, but in a very imperfect condition.

Outside of England there have been only two references to mesozoic Tipulidæ. The first is that of Weyenbergh, who figured (*Arch. Mus. Teyl.*, ii, pl. xxxiv, fig. 6) an exceedingly obscure fossil from the Jura of Solenhofen under the name of *Tipularia ? teyleri*. The author himself says that no trace of neuration can be seen in

the wings. It is quite impossible to place it, except by merest conjecture.

The last instance is to be found in the paper by Brauer, Redtenbacher, and Ganglbaur (*Mém. Acad. St. Petersb.*, (7), xxxvi, 1889) on the Jurassic insects of eastern Siberia; these authors mention among the "Dubiosa," a dipterous pupa "somewhat resembling that of Ptychoptera."

From these unsatisfactory data we may conclude that Tipulinæ and perhaps Limnobiinæ have probably been found as far back as the Jura, but that further details regarding specimens will need to be published before the evidence is satisfactory.

VI. FAMILY TIPULIDÆ.

The two subfamilies of Tipulidæ may be separated by means of the structure of the wings (often the only characteristic part remaining in fair preservation among the fossils) in the following manner:

Auxiliary vein usually ending in the costa and connected by a cross vein with the first longitudinal vein; the latter ends in the costa without aiding in the formation of a trapezoidal cell; last posterior cell in broad contact with the discal cell.....*Limnobiinæ.*

Auxiliary vein ending in the first longitudinal vein by abruptly curving down to it, but otherwise free from it; first longitudinal vein, by an apical incurvation and the emission at its base of an oblique costal cross vein, enclosing a trapezoidal cell at the distal extremity of the stigma; last posterior cell touching the discal cell at only one corner.....*Tipulinæ.*

In the enumeration of the specimens at the end of the following specific descriptions the numbers of the obverse and reverse of the same specimen are always connected by "and" without any intervening comma, and this typographical method is employed only in expressing this relation.

VII. THE SUBFAMILY LIMNOBINÆ.

For the sake merely of simplicity, I use this term to include all the Tipulidæ brevivalpi of authors. There seems to be a greater diversity of structure among them than among the Tipulinæ proper, and they have been divided by Osten Sacken into eight groups,

which may be regarded as tribes, the relative importance of which in recent and ancient times has been pointed out in a preceding table, from which it will appear that every one of them has been recognized among the fossils.

The Limnobini take precedence as they do among modern types, while the Rhamphidini (in Europe in amber only), the Eriopterini, and Limnophilini follow in numbers, the remaining groups being of least importance and three of them altogether lacking in American deposits; while the *Cylindrotomini*, the only remaining tribe appearing in America, is lacking in the European tertiaries. The Anisomerini are represented in Europe by three species of *Eriocera* in amber, the Amalopini by four species of *Ula* in amber, and the Ptychopterini by a single species of *Idioplasta* in the same and by a *Ptychoptera* at Krottensee. It thus appears that with the exception of the Ptychopterini all the tribes represented in the European rock deposits occur also in America, while America is also well represented in the tribes Rhamphidini and Cylindrotomini. The American genus *Pronophlebia* cannot yet be placed.

Especially difficult of determination among the Limnobini has been the position or the absence of the subcostal and marginal cross veins, which play so important a part in the arrangement and distinction of the genera. It is by no means impossible that in some instances I may have erred in my interpretation of marks upon the stones, but I have endeavored to give all points a rigid scrutiny. It is certainly here that errors are most likely to have been made.

Nearly one hundred additional specimens from Florissant, more or less imperfect, but certainly belonging to this subfamily, await study; and I may add that there is a specimen in the collection of the U. S. Geological Survey (No. 1470) which represents an interesting new genus falling near *Atarba* with distinct tibial spurs, but which I refrain from characterizing here, as I can give now no illustration of it.

As the number of genera in no one of the tribes exceeds three, I have thought it best to include all the genera of the subfamily in one table, as follows:

Table of the Genera of American Fossil Limnobiinæ.

- A¹. Only a single submarginal cell.
- b¹. The normal first posterior cell, lying (in forms having but one submarginal cell) between the second and third longitudinal veins, closed, forming at base a supernumerary discal cell..... *Cyttaromyia*.
- b². First posterior cell open throughout.
- c¹. Five posterior cells..... *Oryctogma*.
- c². Four posterior cells.
- d¹. The first longitudinal vein ends in the second longitudinal vein.
- e¹. Discal cell closed; submarginal much longer than first posterior cell..... *Dicranomyia*.
- e². Discal cell open; submarginal scarcely longer than first posterior cell..... *Spiladomyia*.
- d². The first longitudinal vein ends in the costa.
- e¹. A marginal cross vein.
- f¹. Marginal cell excessively long, much exceeding in length the breadth of the wing..... *Limnocema*.
- f². Marginal cell normal, not so long as breadth of cell (applicable to fossil species only)..... *Antocha*.
- e². No marginal cross vein..... *Rhamphidia*.
- A². Two submarginal cells.
- b¹. Third longitudinal vein arising at normal distance from the second.
- c¹. First submarginal cell not, or hardly more than, half as long as the second..... *Gonomyia*.
- c². First submarginal cell much more than half as long as the second.
- d¹. Tibiæ without spurs at the tip.
- e¹. Auxiliary vein ending at a distance beyond the origin of the second longitudinal vein considerably more than equal to the breadth of the wing; third posterior cell petiolate..... *Cladoneura*.
- e². Auxiliary vein (in the fossil species) ending at a distance beyond the origin of the second longitudinal vein less than, sometimes only about half, the breadth of the wing; second posterior cell petiolate..... *Cladura*.
- d². Tibiæ with spurs at the tip..... *Limnophila*.
- b². Third longitudinal vein arising from the second at a very short distance beyond the base of the latter..... *Pronophlebia*.

Tribe CYLINDROTOMINI.

This tribe is placed first in the series instead of near the end really because the arrangement of the table just given requires the early appearance of the two genera recognized in the American

rocks. Its place in the arrangement given by Osten Sacken is rather at the other end of the series in nearer proximity to the Tipulinæ; but it may be noticed that in some of the features in the neuration of the wing, as in the arrangement in the vicinity of the stigma, in which it approaches the Tipulinæ, it also shows most resemblance to the Limnobini.

Although Loew referred some amber species to *Cylindrotoma*, Osten Sacken, who has since examined them, says they are all Limnophilæ, so that the species described below, six species of two genera, both extinct, are the only ones known in a fossil state.

CYTTAROMYIA Scudder.

Cyttaromyia Scudd., *Bull. U. S. Geol. Geogr. Surv. Terr.*, iii, 751 (1877); *Tert. Ins. N. A.*, 574-575 (1891).

This genus was founded, in 1877, upon a specimen showing the apical half of a single wing, somewhat distorted by folding, and rather obscurely preserved, found by Denton among the first known tertiary insects of North America, on the lower White River of Colorado and Utah. A number of specimens and several species of the same genus have since been obtained by me from the same spot, while exploring for the U. S. Geological Survey, but no further specimens of the same species. The beds at Florissant have also yielded several species of the genus and permit a more accurate and complete account of the generic characteristics. These specimens show that my original description was faulty in its interpretation of the structural elements of the wing: the cells lying beyond the "secondary discal cell" were wrongly regarded as submarginal cells, for they belong to the "posterior" series, and all the errors of statement followed from this wrong interpretation; but the neuration is none the less remarkable, and, so far as I have been able to discover, unique.

The wings are very long and slender, four or more times as long as broad. The auxiliary vein ends in the costa, without any sudden curve, at the beginning of the stigma. The first longitudinal vein, by very gradually curving downwards, ends in the second, which curves upward to meet it, forming a long and slender marginal cell; there is neither subcostal nor marginal cross vein. The second longitudinal vein arises near the middle of the wing, varying in the species, is generally considerably arcuate at the base, the præfurca

considerably shorter than the rest of the vein, which terminates above the apex of the wing. The third longitudinal vein arises from the second a little before the tip of the auxiliary vein and is met by the short cross vein at a distance from its origin equal to the length of the short cross vein. The space between the third longitudinal vein and the upper branch of the fourth longitudinal vein, normally—and so far as I am aware invariably—open in all *Limnobia*, is here closed about half way to the tip of the wing (varying in different species) by a cross vein, from which springs an intercalary vein, *thus doubling the upper posterior cell at the apex and forming of its basal portion a supernumerary discal cell*, essentially a counterpart of the normal discal cell and overlying it; it would seem to be formed by a mesial forking of the third longitudinal vein, and the base of the fork then connected by a cross vein to the uppermost branch of the fourth longitudinal vein. Both discal cells are usually very elongate (least so in the species upon which the genus was founded), the upper, or supernumerary, usually the longer and narrower, though they are subequal in length. There are five posterior cells and the great cross vein strikes the fourth longitudinal vein at the discal cell close to the base of the latter. The fifth longitudinal vein is very gently arcuate beyond this cross vein, while the sixth and seventh are straight throughout, the latter, however, arcuate at the extreme tip and almost reaching the middle of the wing. The legs are long and slender and the tibiae without spurs at the tip.

This genus was well developed in the American oligocene, especially in the White River basin, where it seems to include the larger number of species of *Limnobia*. I leave their description, however, to another occasion and characterize at this time only the species found at Florissant, none of which appear to be identical with those from the White River basin. The genus does not appear to be found among the European fossil *Limnobia* heretofore published.

This genus, it seems to me with little doubt, must fall into the *Cylindrotomini*, although the tibiae lack spurs. I am forced to this conclusion by the close resemblance of the neuration to that of *Cylindrotoma* and *Liogma*, notwithstanding the striking differences. Especially the formation of the marginal cell is essentially the same, while the absence of the anterior cross veins and the general behavior of the auxiliary vein sustain this view. It seems to me very

doubtful if the presence or absence of tibial spurs can be of so great significance in the Linnobinæ as seems to be accorded it in the classification of Baron Osten Sacken. But, on the other hand, it is due to classing this genus among the *Cylindrotomini* that this tribe is made to show such an anomalous preponderance in the American tertiaries.

The species mentioned below may be grouped as in the following table :

Table of the Species of Cyttaromyia.

Normal discal cell hardly more than twice as long as broad.....*fenestrata*.

Normal discal cell nearly or quite three times as long as broad.

Discal cell shorter, or no longer, than third posterior cell.

Marginal cell but little longer than breadth of wing....*princetoniana*.

Marginal cell nearly one third longer than breadth of wing...*oligocena*.

Discal cell longer than third posterior cell.

Proximal portion of marginal cell (measured from the point of origin of third longitudinal vein) nearly one third longer than the distal portion; præfurca almost as long as the remainder of second longitudinal vein.....*cancellata*.

Proximal portion of marginal cell only one seventh longer than the distal portion; præfurca only about half as long as the remainder of second longitudinal vein.....*clathrata*.

Cyttaromyia fenestrata.

Cyttaromyia fenestrata Scudd., *Bull. U. S. Geol. Geogr. Surv. Terr.*, iii, 751-752 (1877); *Tert. Ins. N. A.*, 575-576, pl. 5, fig. 78 (1891).

White River, Utah.

Cyttaromyia princetoniana.

Pl. 1, fig. 1.

Wings four times as long as broad, the marginal cell but very little longer than the breadth of the wing, the proximal much longer than the distal portion. Auxiliary vein terminating midway between the origin of the third and the tip of the first longitudinal vein. Second longitudinal vein arising well beyond the middle of the wing, the præfurca about two thirds as long as the rest of the vein. Supernumerary discal cell considerably broadening apically and shorter than the first posterior cell. Discal cell equal, slightly less than three times as long as broad, its distal extremity lying considerably within that of the supernumerary discal cell,

shorter than the third posterior cell. Fifth posterior cell of equal width with the discal cell. Stigma normal.

This species is of about the size of the preceding.

Length of wings, 8.75 mm. ; fore femora, 5.5? mm. ; fore tibiæ, 6.5 mm. ; mid femora, 4.75 mm. ; mid tibiæ, 5.75 mm. ; hind femora, 5.5 mm. ; hind tibiæ, 6.5 mm.

Florissant, Colorado. Five specimens, Nos. 345, 7381, 7591, 13051 ; and from the Princeton collection No. 1.770.

Cyttaromyia oligocena.

Pl. 1, fig. 2.

Wings scarcely more than four times as long as broad, the marginal cell more than one fourth longer than the breadth of the wing, the proximal nearly one half longer than the distal portion. Auxiliary vein terminating beyond a point midway between the origin of the third and the tip of the first longitudinal vein. Second longitudinal vein arising at the middle of the wing, the præfurca about one fourth shorter than the remainder of the vein. Supernumerary discal cell broadening a little apically and as long as the first posterior cell. Discal cell equal, three times as long as broad, its distal extremity lying considerably within that of the supernumerary discal cell, a little shorter than the third posterior cell. Fifth posterior broader than the discal cell. Stigma normal.

This is the largest species of the genus.

Length of wings, 9.65 mm. ; fore femora, 5.25? mm. ; fore tibiæ, 5.75 mm. ; mid femora, 5.5? mm. ; mid tibiæ, 6.25 mm. ; hind femora, 6.25 mm.

Florissant, Colorado. One specimen, No. 13259.

Cyttaromyia cancellata.

Pl. 1, fig. 7.

Wings slightly less than four times as long as broad, the marginal cell nearly one third longer than the width of the wing, its proximal fully a third longer than the distal portion. Auxiliary vein terminating somewhat short of a point midway between the origin of the third and the tip of the first longitudinal vein. Second longitudinal vein arising slightly before the middle of the wing, the præfurca almost as long as the remainder of the vein. Supernumerary discal cell very slender, gently broadening apically, longer

than the first posterior cell. Discal cell equal, fully three times as long as broad, slightly longer than the third posterior cell, its distal extremity on a line with that of the supernumerary discal cell. Fifth posterior no broader than the discal cell. Stigma very faint.

Length of wings, 9 mm.

Florissant, Colorado. One specimen, No. 86.

Cyttaromyia clathrata.

Pl. I, fig. 8.

Wings more than four times as long as broad, the marginal cell more than one fourth longer than the breadth of the wing, its proximal not more than one fifth longer than its distal portion. Auxiliary vein terminating midway or at slightly less than midway from the origin of the third to the tip of the first longitudinal vein. Second longitudinal vein arising at or scarcely before the middle of the wing, pretty strongly arcuate at base, the præfurca only a little more than half as long as the remainder of the vein. Supernumerary discal cell long and slender, very slightly enlarging apically, considerably longer than the first posterior cell. Discal cell enlarging apically, almost four times as long as broad, about as long as the third posterior cell, its distal extremity lying considerably within that of the supernumerary discal cell. Fifth posterior broader than the discal cell. Stigma faint.

This is the smallest species of the genus.

Length of wings, 7.25 mm. ; fore femora, 5 mm. ; fore tibiæ, 6 mm. ; mid tibiæ, 5.75 mm. ; hind femora, 5.25 mm. ; hind tibiæ, 6 6 mm.

Florissant, Colorado. Three specimens, Nos. 3520, 8649 of my collection, No. 1510 U. S. Geological Survey.

ORYCTOGMA (*ὀρυκτὸς, ὄγμος*) gen. nov.

I separate here a single species which seems to belong to the *Cylindrotomini* and to be most nearly allied to *Cylindrotoma* and *Liogma*, but which differs from them as from other living *Cylindrotomini* in that the first longitudinal vein not only ends distinctly in the second, as in *Cyttaromyia*, *Dicranomyia*, and others, but is also connected apically with the costa by a cross vein as distinct as its own deflected apex, the apical portion of the vein appearing rather to fork and send one shoot in each direction. The disposition of

the venation at the ends of the basal cells is much as in *Cylindrotoma*, and not as in *Liogma* and *Triogma*, the short cross vein being present and as long as the peduncle of the third longitudinal vein. The discal cell is brief, and the upper of the three veins emitted from its extremity is deeply forked, so that there are five posterior cells. The tibiæ are distinctly spurred, the spurs short.

These characters hardly permit it to be classed with existing genera, though its relationship to the *Cylindrotomini* is intimate. I am the more assured of the correctness of this view because of the existence in the collection made at Florissant for the U. S. Geological Survey of another allied genus, hitherto unknown, which has a single submarginal cell and spurred tibiæ, and in which the first longitudinal vein ends in precisely the same manner, though the auxiliary vein certainly ends in the costa immediately previous to it. Unfortunately most of the remainder of the neuration is obscured in the single specimen seen (No. 1470).

Oryctogma sackenii.

Pl. 1, fig. 6.

Wings ample, three and a half times longer than broad. The auxiliary vein appears to end free somewhat before the base of the third longitudinal vein. The stigma is distinct, somewhat broad and triangular. The second longitudinal vein arises in a faintly clouded spot at some distance beyond the middle of the wing without basal arcuation, the præfurca being straight and but little shorter than the apical portion of the vein. The marginal cell is only as long as the breadth of the wing and rather broad in the middle. The discal cell is distinctly shorter than the third posterior cell, considerably broader apically than at base. The second posterior cell has a short peduncle; the fifth posterior cell is about twice as long as broad, narrowing a little apically. The fifth longitudinal vein is somewhat bent at the great cross vein; the seventh longitudinal vein is straight like the sixth and ends at or before the middle of the wing. A faint cloud attends the cross veins at the end of the basal cells.

Length of wings, 13 mm.; fore femora, 5.5 mm.; tibiæ, 8 mm.; tarsi, 12.5 mm.; mid femora, 7 mm.; tibiæ, 8.5 mm.; tarsi, 11+ mm.; hind femora, 7 mm.; tibiæ, 7.5 mm.; tarsi, 12 mm.

Florissant, Colorado. One specimen, No. 206.

Named for Baron C. R. von Osten Sacken, without whose studies on recent Tipulidæ, the investigation of the fossil American forms would be attended with far greater difficulty.

Tribe LIMNOBINI.

This is one of the dominant tribes of Limnobiinæ, whether now or in past times. Five genera and more than thirty fossil species are known, the only extinct genera being two—*Spiladomyia* with one, and *Limnocema* with four species, all found in North American rocks. *Dicranomyia* is shared about equally between the Colorado tertiaries and the Baltic amber, while *Geranomyia* and *Limnobia* are known only from Aix and other European deposits, the latter genus in considerable numbers.

DICRANOMYIA Stephens.

Dicranomyia Stephens, *Catal. Brit. ins.*, 243 (1829).

This genus, according to Osten Sacken, probably occurs in all parts of the world, although it may be principally at home in the more temperate latitudes. It appears to have been well developed in our tertiaries, and occurs in equal abundance in the European. The eight fossil European species, still unpublished, all come from amber, and were referred by Loew to a new genus, *Ataracta*, which Osten Sacken says is "apparently synonymous with *Dicranomyia*." In this country, besides the three species already described by me from the lower White River of Colorado and Utah (and to which two of the species described by me as *Tipulæ* must probably be joined) the U. S. Geological Survey has two others from the same locality, and five are described below from Florissant. The described species may be separated by the following table :

Table of the Species of Dicranomyia.

Marginal cell shorter than the breadth of the wing.

Distal portion of marginal cell almost as long as the proximal.

Larger species, with wings about 7 mm. long.....*longipes*.

Smaller species, with wings but little more than 5 mm. long.

stagnorum.

Distal portion of marginal cell much shorter than the proximal.

- Subcostal cross vein lying just before the origin of the second longitudinal vein.....*inferna*.
- Subcostal cross vein lying at the tip of the auxiliary vein, beyond the origin of the second longitudinal vein.*
- Auxiliary vein ending at a distance beyond the origin of the second longitudinal vein equal to the width of the marginal cell.
- Great cross vein running in exact continuity with the basal portion of the anterior branch of the fourth longitudinal vein.....*fragilis*.
- Great cross vein striking the discal cell beyond the origin of the anterior branch of the fourth longitudinal vein.
stigmosa.
- Auxiliary vein ending barely beyond the origin of the second longitudinal vein.....*primitiva*.
- Marginal cell as long as the breadth of the wing.
- Smaller species, the wings less than 6 mm. long.....*fontainei*.
- Larger species, the wings more than 7 mm. long.....*rostrata*.

Dicranomyia longipes.

Pl. 1, figs. 4, 5.

This is one of the largest species of those found at Florissant. The auxiliary vein ends barely beyond the origin of the præfurca, but the position of the subcostal cross vein cannot be determined. The præfurca arises considerably beyond the middle of the wing, though nearer to it than in the other species having, like this, a marginal cell shorter than the breadth of the wing; the distal portion of this cell is of about the same length as the proximal, and it terminates by the abrupt descent of the first longitudinal vein upon the second. The discal cell is closed, and is much narrower apically than at base by the length of the third posterior cell. The legs are very long and slender.

Length of wings (in largest specimen), 7 mm. ; fore femora, 5.5 mm. ; fore tibiæ, 6.25 mm. ; fore tarsi, 6? mm. ; mid and hind femora, 7.25 mm.

Florissant, Colorado. Two specimens, Nos. 214, 5582.

Dicranomyia stagnorum.

Pl. 2, figs. 4, 8.

In this species, the most abundant in specimens known, the auxiliary vein terminates barely beyond the origin of the præfurca,

* This is not quite certain as regards *D. stigmosa*, but appears to be the case.

and the subcostal cross vein lies as much before that origin as a little more than half the width of the marginal cell. The præfurca arises at about three fifths the distance from the base of the wing to the tip; the marginal cell is distinctly shorter than the breadth of the wing, its distal portion almost as long as the proximal. The first longitudinal vein descends obliquely but with some abruptness upon the second. The discal cell is closed, broadest apically, the second and third posterior cells of equal length, and the great cross vein strikes the lower inner angle of the discal cell. The legs are long and very slender, and the tarsi show the peculiar arcuation of the apical joint characteristic of *Dicranomyia*; the tibiæ have no spurs.

One specimen (No. 3683) has the discal cell open and continuous with the third posterior cell; in others the cross vein closing the cell is weak.

Length of wings, 5–6.5 mm., aver. 5.5 mm.; fore femora, 4.75 mm.; tibiæ, 5.6 mm.; tarsi, 6.5 mm.; mid femora, 5.2 mm.; tibiæ, 5.25 mm.; tarsi, 5.75 mm.; hind femora, 5.5 mm.; tibiæ, 6.25 mm.; tarsi, 5.5 mm. The leg measurements are from the smallest specimen.

Florissant, Colorado. Thirty-one specimens, Nos. 60, 73, 223, 581, 710, 774, 779, 808, 982, 1486, 2687, 2927, 3683, 6273 and 6416, 8439, 8472, 8751, 8865, 8904, 9127, 9626, 9665, 10268, 12230, 12612, 12760, 13043, 13684 of my collection; Nos. 1.727, 1.791 of the Princeton collection; No. 1512 U. S. Geological Survey.

Dicranomyia inferna.

Pl. 1, fig. 3.

Here the auxiliary vein terminates a very short distance beyond, and the subcostal cross vein lies at an equal distance before the origin of the præfurca, which arises beyond the basal two fifths of the wing. The marginal cell is short, considerably shorter than the breadth of the wing, and the distal portion considerably shorter than the proximal. The first longitudinal vein descends with considerable abruptness upon the second, which curves gently upward to meet it. The discal cell, which is closed, is slightly the broadest apically, and the second and third posterior cells are of equal length. The legs are long and slender, but in no case very fully preserved; they are relatively a little shorter than in the two preceding species, the hind femora being shorter than the wings.

Length of wings, 6.75 mm. ; fore femora, 4.75 mm. ; tibiæ, 5.5 mm. ; hind femora, 5.75 mm. ; tibiæ, 6.25 mm.

Florissant, Colorado. Three specimens, Nos. 3751, 8050 and 8151, 13715. The last is accompanied and partly overlain by a specimen of *D. fontainei*.

Dicranomyia fragilis.

Pl. 2, fig. 3.

This appears to be the most abundant species of *Dicranomyia* at Florissant after *D. stagnorum*. The auxiliary vein terminates at a little distance beyond the origin of the præfurca, equal to about the width of the marginal cell, and has the subcostal cross vein at its tip. The præfurca arises at no great distance beyond the middle of the wing, but the marginal cell is nevertheless much shorter than the breadth of the wing, and its distal much shorter than its proximal portion. The first longitudinal vein descends obliquely though rather rapidly to the second longitudinal, giving a pointed extremity to the marginal cell. The discal cell is closed and a little broader apically than at base, the second and third posterior cells short and subequal. The great cross vein strikes the inner lower angle of the discal cell. A delicate fringe of moderately long microscopic hairs can sometimes be seen around the entire wing, subrecumbent and stouter on the costa than elsewhere, nearly erect on the lower margin. Legs slender, the femora gradually thickened at apex, the tibiæ apically spined, and the apical joint of tarsi characteristically arcuate.

Length of wings, 6–6.5 mm. ; of legs in smallest specimens: fore femora, 4.5 mm. ; tibiæ, 5.75 mm. ; tarsi, 6 mm. ; mid femora, 6.3 mm. ; tibiæ, 6.4 mm. ; tarsi, ? ; hind femora, 6.4 mm. ; tibiæ, 6.75 mm. ; tarsi, 4.75 mm.

Florissant, Colorado. Eleven specimens, Nos. 1388, 1997, 4701, 5463, 6708, 7207, 8553, 8716, 11831, 12127, 13258.

Dicranomyia stigmosa.

Dicranomyia stigmosa Scudd., *Bull. U. S. Geol. Geogr. Surv. Terr.*, iii, 746–748 (1877); *Tert. Ins. N. A.*, 568–570, pl. 5, figs. 16, 17, 25–27, 42, 43, 68, 69 (1891).

?*Tipula tecta* Scudd., *Bull. U. S. Geol. Geogr. Surv. Terr.*, iii, 752–753 (1877); *Tert. Ins. N. A.*, 577, pl. 5, figs. 46, 47 (1891).

In the description given of this species I have inadvertently

spoken of the marginal as the subcostal cross vein. The specimen described by me as *Tipula tecta* certainly belongs to the *Limnobia*, and is most probably referable to this species.

Lower White River, at the boundary between Colorado and Utah.

Dicranomyia primitiva.

Dicranomyia primitiva Scudd., *Bull. U. S. Geol. Geogr. Surv. Terr.*, iii, 748 (1877); *Tert. Ins. N. A.*, 570-571, pl. 5, figs. 20, 21, 65-67 (1891).

The auxiliary vein in the only well-preserved specimen of this species is excessively faint, but appears to terminate barely beyond the origin of the præfurca and the subcostal cross vein to be at its tip. I have accordingly placed it in the table next *D. fragilis* and *D. stigmosa*.

Lower White River, at the boundary line between Utah and Colorado.

Dicranomyia fontainei.

Pl. 2, fig. 1.

This is one of the smallest of the Florissant species, and differs from all the others in having the marginal cell as long as the breadth of the wing. The auxiliary vein is also much longer than in the others, extending far beyond the origin of the præfurca and apparently, though this is obscure, with the subcostal cross vein at its tip. Further, the first longitudinal vein falls upon the second at a slighter angle, giving the marginal cell an unusually pointed tip. The præfurca arises not very far beyond the middle of the wing, and the distal portion of the marginal cell is not much more than half as long as the proximal. The discal cell is closed, though the cross vein separating it from the third posterior cell is very faint, as is also the great cross vein, which appears to strike the inner lower angle of the discal cell. The second and third posterior cells are subequal, the second slightly the longer. The legs are poorly preserved on the two specimens known, but the hind femora appear to be somewhat shorter than the wings.

Length of wings, 5.5-5.75 mm. ; hind femora, 5 mm.

Named for Prof. W. M. Fontaine of the U. S. Geological Survey.

Florissant, Colorado. Two specimens, Nos. 173, 13715, the latter partly overlying a specimen of *D. inferna*.

Dicranomyia rostrata.

Dicranomyia rostrata Scudd., *Bull. U. S. Geol. Geogr. Surv. Terr.*, iii, 749 (1877); *Tert. Ins. N. A.*, 571-572, pl. 5, figs. 40, 41, 63, 64 (1891).

Tipula decrepita Scudd., *Bull. U. S. Geol. Geogr. Surv. Terr.*, iii, 752 (1877); *Tert. Ins. N. A.*, 576-577, pl. 5, figs. 56, 57 (1891).

Renewed examination of the material formerly studied shows these two supposed distinct species to be in all probability identical.

Lower White River, at the boundary between Utah and Colorado.

SPILADOMYIA Scudder.

Spiladomyia Scudd., *Bull. U. S. Geol. Geogr. Surv. Terr.*, iii, 749 (1877).

In this genus the discal cell is open and continuous with the second posterior cell, while the first posterior cell is scarcely longer than the submarginal. In other respects it is closely allied to *Dicranomyia*. In a second species belonging to the U. S. Geological Survey (No. 1069) the auxiliary vein continues to the stigma and as it otherwise agrees tolerably well with the described species where the auxiliary vein is very obscure, the generic characterization given should probably be modified to that extent. In both species, the second longitudinal vein appears to rise towards the first at their apical junction, giving the terminal portion the appearance of being a continuation of the first rather than of the second longitudinal vein. I leave the description of the new species to another occasion.

Spiladomyia simplex.

Spiladomyia simplex Scudd., *Bull. U. S. Geol. Geogr. Surv. Terr.*, iii, 750 (1877); *Tert. Ins. N. A.*, 573, pl. 5, figs. 37, 38 (1891).

Lower White River, next the boundary between Colorado and Utah.

LIMNOCEMA (λίμνη, κείματα) gen. nov.

This name is proposed for a group of species which seem to be more nearly allied to *Limnobia* and *Trochobola* than to any other living genus, but which are peculiar for the presence of a marginal cross vein near the extreme apex of the wing, well beyond the position of the stigma, which is here marked only by a faint cloud; and for the great length of the posterior cells, as in *Dicranoptycha*,

for example. The wings are a little less than four times as long as broad. The auxiliary vein is very long, terminating at or beyond the origin of the third longitudinal vein, and is connected at some distance before its tip with the first longitudinal vein by the subcostal cross vein. The second longitudinal vein arises well before the middle of the wing, the præfurca but little declivent, so that the marginal cell is slender throughout and exceedingly long, since the marginal cross vein is situated at but little before the tip of the first longitudinal vein and scarcely at all affects the curvature either of that or of the second longitudinal vein. The single submarginal is considerably longer than the first posterior cell, and all the posterior cells, four in number, are long, the discal cell being closed and generally less than twice as long as broad. The great cross vein strikes the discal cell slightly beyond the base of the latter. The legs are slender, the tips of the tibiæ unarmed. The abdomen appears to have been longitudinally striped.

Four species occur, each of them at Florissant only; they may be separated by the following table :

Table of the Species of Limnocema.

Second longitudinal vein arising within the basal third of the wing.	<i>marcescens.</i>
Second longitudinal vein arising beyond the basal third of the wing.	
Subcostal cross vein lying a long distance from the tip of the auxiliary vein.	
Præfurca arising before the middle of the wing; submarginal much longer than the first posterior cell.	<i>lutescens.</i>
Præfurca arising at or beyond the middle of the wing; submarginal scarcely longer than the first posterior cell.	<i>styx.</i>
Subcostal cross vein lying a short distance from the tip of the auxiliary vein.	<i>mortoni.</i>

Limnocema marcescens.

Pl. 2, fig. 7.

This is the largest species of the genus, and remarkable for the excessive length of the marginal cell, which is more than half as long as the wing. The auxiliary vein ends just at the origin of the third longitudinal vein, but the subcostal cross vein cannot be made out. The second longitudinal vein arises distinctly within the basal third of the wing, and the marginal cross vein is so near its tip that the proximal and distal portions of the marginal cell are about equal. The discal cell is relatively small and narrower apically than at base, and the second and third posterior cells are slender

and twice as long as the discal cell. The wings are uniformly and very slightly fuliginous, but no trace of stigma can be detected. The hind (or middle?) femora are much shorter than the wings.

Length of wings, 10.75 mm. ; hind (or mid?) femora, 8 mm. ; tibiæ, 9 mm.

Florissant, Colorado. One specimen, No. 13069.

Limnocema lutescens.

Pl. 2, fig. 2.

The auxiliary vein in this species ends a little way beyond the origin of the third longitudinal vein, and the subcostal cross vein is at a considerable distance before it, about half way to the origin of the præfurca, and at about the middle of the wing. The second longitudinal vein arises at some distance before the middle of the wing, and the marginal cross vein is at some distance before the tip of the second longitudinal vein, so that the distal is but slightly longer than the proximal portion of the marginal cell. In neither of the known specimens are the parts about the discal cell well preserved, but the posterior cells can be seen to be very long, and the submarginal to be much longer than the first posterior cell. One of the specimens shows a slight infumation in the position of the stigma.

This species bears a close general resemblance to the larger *Rhamphidia saxetana* from the same beds, which lacks any marginal cross vein.

Length of wings, 8.2–9.5 mm. ; fore femora of larger specimen, 5.75 mm. ; tibiæ, 6.75 mm. ; mid femora of smaller specimen, 5.5 mm. ; tibiæ 5.75 mm.

Florissant, Colorado. Two specimens, Nos. 603, 11817.

Limnocema styx.

Pl. 2, fig. 6.

This species is very near the last, and the single specimen is imperfect by the loss of the tip of the wing. It differs from the preceding mainly in these points: The subcostal cross vein, though situated, as there, about midway between the tip of the auxiliary vein and the base of the præfurca, is very far beyond the middle of the wing, for the præfurca arises not far from and probably itself

beyond the middle of the wing. The position of the marginal cross vein, being beyond the break, cannot be determined, and it is therefore possible that this species does not belong in this genus at all. The submarginal is but very little longer than the first posterior cell. The discal cell must be of excessive length if it is not open, as it cannot be seen on the fragment, which is supposed to include just about one half of the apical cellular area, that is, the region beyond the basal cells. The wing is perfectly clear except that faint signs of a stigma can be seen just beyond the tip of the auxiliary vein.

Length of fragment of wing, 8 mm. ; presumed length of wing, 9.5 mm. ; hind femora, 6 mm. ; tibiæ, 6.25 mm.

Florissant, Colorado. One specimen, No. 11389.

Limnocema mortoni.

Pl. 2, fig. 5.

A single specimen with its reverse represents the smallest of the species of this genus. The outspread wings show a faint broadly diffused infumation in the region of the stigma, but are otherwise, and excepting the dark veins, hyaline. The auxiliary vein ends at a noticeable distance beyond the origin of the third longitudinal vein, and the subcostal cross vein lies directly over the latter, and so at considerably less than half way from the tip of the auxiliary vein to the origin of the præfurca. The latter arises somewhat before the middle of the wing, and the marginal cross vein is close before the tip of the first longitudinal vein, so that the marginal cell is very long, and its distal a little longer than its proximal portion. The submarginal is much longer than the first posterior cell,—indeed by as much as the length of the discal cell, which is here only about half as long again as broad, and considerably less than half as long as the slender posterior cells beyond it. A single femur is all that is preserved of the legs—a fore femur, to judge by its position, and in that case exceptionally long, being but little shorter than the wings.

Length of wings, 7.9 mm. ; fore? femora, 6.25 mm.

Named in memory of Dr. S. G. Morton, the distinguished Philadelphia naturalist of a past generation.

Florissant, Colorado. One specimen, Nos. 8038 and 8215.

Tribe RHAMPHIDINI.

I have chosen to call this tribe by a name derived from one of its principal genera, rather than to use the compound term *Limnobia anomala* introduced by Osten Sacken. The Rhamphidina of this writer is a more restricted group within this.

Four genera and a dozen species of this tribe are known in a fossil state, all the genera but one, *Antocha*, being found in amber. None of the genera are extinct, though two of them were first known from amber inclusions, and in consequence have been the subject of many comments by Loew and Osten Sacken, who find in them striking examples of the resemblance between the amber fauna and the existing fauna of America. None of this tribe have been recognized in the European rock deposits, but Florissant furnishes two genera and four species.

RHAMPHIDIA Meigen.

Rhamphidia Meig., *Syst. Besch. eur. zweifl. Ins.*, vi, 281 (1830).

In this genus are here placed several species which agree in their neurulation quite as well with *Toxorhina*, but appear to lack the elongated rostrum of the latter genus. The neurulation, however, shows so many minor points of departure from the described characteristics of each of these genera, that the characters of *Rhamphidia* must be made more elastic for their reception. Among themselves they differ also in similar particulars, and until the fossil species indicated from amber are better known, enabling us to compare all the Rhamphidini living and fossil, it will probably be best to include these under *Rhamphidia*, to which they appear to be most nearly allied. There is no trace in them of apical spurs to the tibiæ. Attention should especially be directed in studying the fossil species to the length of the auxiliary vein, the point of origin of the præfurca, and the position of the great cross vein.

This genus contains but few species, most of which are found in Europe, the others in eastern North America, Porto Rico, and Brazil (one each). Four undescribed species are recorded by Loew as occurring in Baltic amber. The three species found at Florissant may be thus separated :

Table of the Species of Rhamphidia.

Auxiliary vein ending opposite the origin of the third longitudinal vein. . . *saxetana*.
 Auxiliary vein ending about midway between the origin of the second and third longitudinal veins.

- Third longitudinal vein arising about the middle of the wing; great cross vein striking the fourth longitudinal vein before the discal cell.*fæcaria*.
 Third longitudinal vein arising well beyond the middle of the wing; great cross vein striking the fourth longitudinal vein at the base of the discal cell*loewi*.

Rhamphidia saxetana.

Pl. 3, fig. 4.

An exceptionally large species. The auxiliary vein ends opposite the origin of the third longitudinal vein, but the position of the subcostal cross vein cannot be made out. The præfurca arises at the middle of the wing, is arcuate at its base and then subparallel to the first longitudinal vein, and not half so long as the remainder of the vein. The first longitudinal vein is carried much farther toward the apex of the wing than in the other species, farther beyond the long auxiliary vein than the breadth of the wing. The submarginal is not very much longer than the first posterior cell. The discal cell is rather short, and the posterior cells beyond it more than twice as long as it. The great cross vein strikes the discal cell close to the base of the latter. The costal margin of the wing is very thick and deeply colored; the wing itself is hyaline, with scarcely even a fuliginous tint at the stigma. The legs are slender, the femora gradually thickening toward the tip.

Length of wings, 12 mm. : fore femora, 8.25 mm. ; tibiæ, 9.75 mm. ; tarsi, 9 mm. ; mid femora, 9.5 mm. ; tibiæ, 9.25 mm. ; hind femora, 9.5 mm.

One cannot but be struck by the close general resemblance of this species to the much smaller *Limnocema lutescens* from the same beds, a species with a marginal cross vein.

Florissant, Colorado. One specimen, No. 10490.

Rhamphidia fæcaria.

Pl. 3, fig. 5. .

The auxiliary vein ends midway between the origin of the second and third longitudinal veins, the subcostal cross vein at its very tip. The præfurca arises at the middle of the wing, is gently arcuate and slightly declivent and distinctly more than half as long as the remainder of the vein. The first longitudinal vein ends as far from the origin of the third as that is from the origin of the second

longitudinal vein, and at a less distance beyond the tip of the auxiliary vein than the breadth of the wing. The submarginal is much longer than the first posterior cell. The discal cell is moderately small, equal, about half as long again as broad and distinctly but not greatly shorter than the posterior cells beyond it. The great cross vein strikes the fourth longitudinal vein at a slight distance before the discal cell. The seventh longitudinal vein is rather short. A slight infumation marks broadly the position of the stigma, the veins are all exceptionally heavy and fusco-luteous, the wing barely infumated. Three legs are preserved on the single specimen known and are presumed to be the hind pair and one middle leg.

Length of wings, 7.5 mm. ; mid femora, 5.2 ? mm. ; tibiæ, 5.5 mm. ; hind femora, 5.2 ? mm. ; tibiæ, 5.75 mm. ; tarsi, 5 mm.

Florissant, Colorado. One specimen, No. 9399.

Rhamphidia loewi.

Pl. 3, fig. 2.

The auxiliary vein ends at a little less than half way from the origin of the second to that of the third longitudinal vein, the subcostal cross vein at its tip. The præfurca arises considerably beyond the middle of the wing, is nearly straight and declivent, and is less than half as long as the remainder of the vein. The first longitudinal vein is as in the preceding species. The submarginal is much longer than the first posterior cell. The discal cell is rather elongate, equal, twice as broad as long and fully as long as the posterior cells beyond it. The great cross vein strikes the discal cell near to but distinctly removed from the base of the latter. The seventh longitudinal vein is normal. The wing is hyaline, with a very faint infumation at the stigma, the veins luteous and delicate. The legs are detached and partly obscured (though in a natural position) so that the measurements are mostly in doubt.

Length of wings, 7.25 mm. ; fore femora, 5.5 ? mm. ; tibiæ, 6.5 mm. ; mid femora, 6 ? mm. ; tibiæ, 6.5 ? mm. ; hind femora, 6.4 ? mm.

Named in memory of Dr. H. Loew, the distinguished investigator of the amber Diptera.

Florissant, Colorado. One specimen, No. 1369.

ANTOCHA Osten Sacken.

Antocha Osten Sacken, *Proc. Acad. Nat. Sc. Philad.*, 1859, 219.

To this genus I refer a single species which differs markedly from the only recent species known—occurring in eastern North America and in Europe—in the character of the præfurca, which is arcuate at base and only half as long as the rest of the vein, so that the marginal cell is relatively brief. It differs further in minor points, such as the normal removal of the discal cell from the apex of the wing, the normal base of the first posterior cell, etc., but these are of much less importance. If the entire neuration could be determined with accuracy I am disposed to believe it would have to be separated from *Antocha*; but the position of the marginal cross vein just before the tip of the first longitudinal vein, the gradual approach of the first longitudinal vein to the costal margin, and the apparent merging of the auxiliary in the first longitudinal vein (though this is an obscure point) are so many features in common with *Antocha* that it seems best to place it here at present. The shape of the anal angle of the wing cannot be determined. The tips of the tibiæ are unarmed.

“It is not at all improbable,” wrote Osten Sacken more than thirty years ago (*l. c.*, 200), “that my genera *Antocha* and *Dicranoptycha* will be found fossil in the Prussian amber.” The present illustration is almost a fulfilment of this partial prophecy.

Antocha principialis.

Pl. 3, fig. 1.

Represented by a single specimen with rather obscure neuration over most of one wing and the whole of the other. The auxiliary vein appears to unite with the first longitudinal vein about the middle of the wing. The latter runs very gradually into the margin, without curving upward toward it, at a point about as far beyond the origin of the third, as that is beyond the origin of the second longitudinal vein. The præfurca arises a little beyond the middle of the wing, is at first strongly arcuate, then subparallel to the margin, toward which it turns slightly at the marginal cross vein, which is opposite the base of the discal cell, a little within the tip of the first longitudinal vein, at the inner margin of the faint stigma. The submarginal is much longer than the first posterior

cell, but by no means so much so as in the living species. The discal cell is long and rather slender, widening apically and as long as the third posterior cell. The great cross vein strikes the fourth longitudinal vein at some distance short of the discal cell. The legs are very slender and the fore tarsi of excessive length.

Length of wings, 6.5 mm. ; fore femora, 5.25 mm. ; tibiæ, 5.5 mm. ; tarsi, 10.5 mm. ; mid femora, 5.75 mm. ; tibiæ, 6 mm. ; tarsi, 6.25 mm. ; hind femora, 6 mm.

Florissant, Colorado. One specimen, No. 215.

Tribe ERIOPTERINI.

Of this tribe five genera and eighteen species, including those described below, are known in a fossil state. Only three species of as many genera—Erioptera, Gnophomyia, and Gonomyia—have been described from the European rocks, but eight species of Erioptera are said by Loew to occur in amber. Gonomyia has four species in America, and Cladura has two, while a single other species has been referred to a distinct genus, Cladoneura, closely allied to the last.

GONOMYIA Megerle.

Gonomyia Meg., in Meig., *Syst. Besch. eur. zweifl. Ins.*, i, 147 (1818).

This is a north temperate genus, the known existing species being confined to Europe, which has eleven species, and eastern North America, which has five. It has before this been found fossil, the species described by Heyden in the Aquitanian of Rott in Rhenish Prussia under the name of *Limnobia sturi*, being certainly a Gonomyia. But in this country it is found fossil more abundantly, for to this genus belong four nearly allied species from Florissant with very characteristic neuration. Except that the auxiliary vein is relatively long and the marginal cell slender, they do not appear to differ in any common characteristics from modern forms. The species may be separated thus :

Table of the Species of Gonomyia.

Præfurca with little or no basal arcuation, nearly straight throughout.

Base of first submarginal cell lying scarcely beyond the tip of the first longitudinal vein.

- Small species. Tip of auxiliary vein lying much less than half way from the origin of the second to the origin of the third longitudinal vein.....*profundi*.
- Large species. Tip of auxiliary vein lying much more than half way from the origin of the second to the origin of the third longitudinal vein.....*labefactata*.
- Base of first submarginal cell lying distinctly beyond the tip of the first longitudinal vein.....*primogenitalis*.
- Præfurca with strong arcuation at base.....*frigida*.

Gonomyia *profundi*.

Pl. 3, fig. 3.

The wings are hyaline. The auxiliary vein ends barely before the middle of the wing and a little distance beyond the origin of the præfurca, the subcostal cross vein appearing to lie midway between the two. The first longitudinal vein ends in the costa opposite the middle of the discal cell. The præfurca is long, nearly straight, arises at the end of the basal two fifths of the wing, and is considerably more than half as long as the rest of the vein. The oblique upper branch of the second longitudinal vein arises opposite the tip of the first longitudinal vein, making the first submarginal cell more than half as long as the second; the latter is considerably longer than the first posterior cell, and the second and third posterior cells twice as long as the discal cell, which is closed. All the veins running longitudinally are gently and uniformly arcuate.

This is the smallest of the fossil species of the genus.

Length of wings, 5 mm. ; fore femora, 2.75 mm. ; tibiæ, 2.75 mm. ; mid femora, 3 mm. ; tibiæ, 3 mm. ; hind femora, 3 ? mm. ; tibiæ, 3 mm. ; tarsi, 3.25 mm.

Florissant, Colorado. One specimen, No. 7461.

Gonomyia *labefactata*.

Pl. 4, fig. 4.

The wings are hyaline, without trace of color except the luteous veins, which appear to be a little thickened in certain parts, especially the fifth longitudinal vein; there is no trace of a stigma. The auxiliary vein terminates at a remarkable distance beyond the origin of the præfurca, reaching nearly to the base of the third longitudinal vein, and well beyond the middle of the wing, the

subcostal cross vein shortly anterior to its tip. The first longitudinal vein reaches as far as opposite the distal end of the discal cell. The præfurca arises at about the end of the basal two fifths of the wing, is straight, not very long, but little more than half as long as the remainder of the vein. The oblique upper branch of the second longitudinal vein arises directly opposite the tip of the first longitudinal vein, so that the first submarginal cell is just as long as its petiole. The second submarginal is but little longer than the first posterior cell. The discal cell is pretty large and nearly as long as the posterior cells beyond it. The great cross vein strikes it just before its middle.

This is the largest of the fossil *Gonomyia*.

Length of wings, 8.25 mm.

Florissant, Colorado. One specimen, No. 147.

Gonomyia primogenitalis.

Pl. 4, fig. 10.

In this species the wings are hyaline, without spots or stigma, but with fusco-luteous veins. The auxiliary vein ends in the middle of the wing, the subcostal cross vein shortly before its tip and nearly midway to the base of the præfurca, which, though no longer than usual, arises at an exceptionally early point, not far beyond the basal third of the wing; it is straight, with no basal arcuation whatever, and only half as long as the rest of the vein; indeed the whole cellular area of the wing, that is, the region beyond the basal cells, is much longer in proportion to the rest of the wing than in any of the other species. The first longitudinal vein ends about opposite the distal end of the discal cell, and the oblique upper branch of the second longitudinal vein arises distinctly beyond its tip, though the first marginal cell is longer than its petiole. The submarginal is not greatly longer than the first posterior cell; the discal cell is rather small and only about half as long as the posterior cells beyond it, the great cross vein striking it at the end of its basal third. The fifth longitudinal vein is scarcely bent at the cross vein. The femora are considerably thickened apically.

The figure on the plate represents only the wing of one of the specimens, drawn by the camera lucida.

Length of wing, 6.5–7.5 mm.; legs in the smaller specimens: fore femora, 2.6 mm.; tibiæ, 3.25 mm.; tarsi, 2.75 mm.; mid

femora, 2.25 mm. ; tibiæ, 2.5 mm. ; tarsi, 2.4 mm. ; hind femora, 3.2 mm. ; tibiæ, 3.1 mm. ; tarsi, 2.25 ? mm.

Florissant, Colorado. Three specimens, Nos. 8161, 8846 and 8871 of my collection ; No. 1.748 of the Princeton collection.

Gonomyia frigida.

Pl. 4, fig. 9.

Wings hyaline without spots or stigma, the veins fuscous. Auxiliary vein terminating a little beyond the middle of the wing, and not far from midway between the origin of the second and third longitudinal veins, the subcostal cross vein shortly before its tip and midway between it and the base of the præfurca. First longitudinal vein ending about opposite the distal extremity of the discal cell. Præfurca arising somewhat before the middle of the wing, strongly arcuate at base, thereafter subparallel to the first longitudinal vein, the strongly oblique upper branch of the second arising opposite the tip of the first longitudinal vein, the first submarginal cell about as long as its petiole. Second submarginal considerably longer than the first posterior cell. Discal cell small, equal, considerably shorter than the posterior cells beyond it, the great cross vein striking it close to its base. The femora are gradually though very slightly thickened and darkened apically.

Length of wings, 5.5–5.75 mm. ; fore femora, 2.8 mm. ; tibiæ, 3 mm. ; tarsi, 3 mm. ; mid femora, 3 mm. ; tibiæ, 2.75 mm. ; tarsi, 2.75 mm. ; hind femora, 3.5 mm. ; tibiæ, 3 mm. ; tarsi, 3.25 mm.

Florissant, Colorado. Three specimens, Nos. 3434, 6034, 8656.

CLADONEURA (*κλάδος, νευρά*) gen. nov.

Among the species which in my preliminary survey of these fossils I had grouped under *Cladura*, is one which agrees with modern forms of that genus in one particular, namely, the distance between the base of the præfurca and the tip of the auxiliary vein, which more than equals the breadth of the wing ; while in the fossil species of *Cladura* described below the distance is less, sometimes much less, than the breadth. It further agrees better with the modern than with the fossil species of *Cladura* in that the tip of the auxiliary vein extends a little beyond the base of the first submarginal cell ; and in that the petiole of this cell about equals the

distance between the subcostal and marginal cross veins,—points more or less related. But it differs from the modern forms of *Cladura* in so many and, as it appears to me, so much more important points than do the fossil species here referred to *Cladura*, that it seems more rational to separate it generically from both.

The points of its distinction from *Cladura* are the following: The præfurca arises at a far earlier point in the wing, at the end of the basal third of the same, and though immediately arcuate has but a slight basal curve and is thereafter straight, running very near to and but slightly divergent from the first longitudinal vein; in this respect the fossil species of *Cladura* agree more nearly with it than with the recent species. The subcostal cross vein is at the tip of the auxiliary vein, so that its distance from the base of the præfurca is a fourth more than the breadth of the wing. The marginal cross vein is in consequence much nearer the subcostal cross vein than the tip of the first longitudinal vein, and the petiole of the first submarginal cell is a little longer than the interval between the two cross veins. Moreover, the branch of the second longitudinal vein through which the first submarginal cell originates is straight throughout and not, as in the modern species of *Cladura*, strongly arcuate basally; in this particular again the fossil species of *Cladura* agree rather with *Cladoneura*. The third and not the second posterior cell is petiolate. The anterior branch of the fourth longitudinal vein arises at a small angle (and not at nearly or quite a right angle) from the main stem, so that the proximal end of the discal cell is pointed and not broad. Finally, the great cross vein lies much nearer the margin of the wing, striking the discal cell opposite the origin of the posterior branch of the fourth longitudinal vein. In addition, the legs, which are very imperfectly known in the single specimen preserved, appear to be much shorter than in the fossil species of *Cladura*, the hind femora being but about half as long as the wings, while in the latter they are fully two thirds as long. The wings are but little more than three times as long as broad, with rather full posterior margin.

A single species is known.

Cladoneura willistoni.

Pl. 4, fig. 2.

Wings a little more than three times as long as broad, immaculate, without stigma, very feebly infumate. The auxiliary vein

ends scarcely before the middle of the apical half of the wing and just beyond the extreme base of the first submarginal cell, the subcostal cross vein next its tip. The præfurca arises at the end of the basal third of the wing and is scarcely shorter than the rest of the vein. The marginal cross vein is as far beyond the base of the first submarginal cell as that from the origin of the third longitudinal vein; the latter is hardly in the least bent at its base where united to the branch of the fourth longitudinal vein. The second submarginal and first posterior cells are of almost equal length and longer than the breadth of the wing. The discal cell is subtriangular, enlarging toward its rectangular apex from its pointed base. Petiole of third posterior cell shorter than the cell. Fifth longitudinal vein distinctly and considerably bent at the great cross vein, the fifth posterior cell less than twice as long as its median breadth. The legs are imperfectly preserved, but are relatively very short.

Length of wings, 9 mm. ; breadth, 2.75 mm.

Named for Prof. S. W. Williston, of the University of Kansas, a diligent student of American Diptera.

Florissant, Colorado. Two specimens, Nos. 9312, 12688.

CLADURA Osten Sacken.

Cladura Osten Sacken, *Proc. Acad. Nat. Sc. Philad.*, 1859, 229.

Cladura is a North American genus and has indeed been found only along the eastern shore from Canada to the District of Columbia. Loew described a European species, but Osten Sacken says it cannot be placed here. Two living species only are known. Up to this time it has not been found fossil, but I now place here a couple of species from Florissant, differing considerably from each other, in that one, a stout species, has spotted wings, very short and broad for a *Cladura*; while the other, a slender form, has clear wings of the usual proportions, nearly four times as long as broad. They agree, however, tolerably well in their neuration, but differ from modern species of *Cladura* in that the distance between the base of the præfurca and the tip of the auxiliary vein is less than, in the stout form hardly more than one half, the breadth of the wing; in that the tip of the auxiliary vein lies distinctly before the base of the first submarginal cell; that the petiole of this cell is only about half as long as the distance between the subcostal and marginal cross veins; and in the slight basal arcuation and subsequent

straightness of the præfurca—in which particular they approach *Cladoneura*, just described. The stouter of the two further differs from modern species of *Cladura* in the form of the wings, as above remarked, and in the somewhat greater distance of the great cross vein from the base of the discal cell. These differences seem to be no more than we should expect between living and tertiary forms in the same genus, and indicate the direction development has taken within relatively recent times.

Table of the Fossil Species of Cladura.

- Wings less than three times as long as broad, spotted; great cross vein striking middle of lower margin of discal cell. *maculata*.
 Wings more than three times as long as broad, immaculate; great cross vein striking lower margin of discal cell near the base. *integra*.

Cladura maculata.

Pl. 4, fig. 1.

Wings slightly less than three times as long as broad, spotted with brownish fuscous along the front margin, but otherwise hyaline; the largest of these spots is at the stigma, where it is more luteous and includes the marginal cross vein; the others are situated next the humeral cross vein, midway between it and the base of the præfurca, at that base, at the subcostal cross vein, at the origin of the third longitudinal vein, and at the tips of the veins bordering the first submarginal cell. The auxiliary vein ends at the distal extremity of the middle fifth of the wing, earlier than the origin of the third longitudinal vein, and has the subcostal cross vein a very little way before its tip. The præfurca arises at the proximal end of the middle fifth of the wing, is arcuate at extreme base, thereafter straight and a little divergent from the first longitudinal vein, and is a little shorter than the rest of the vein. The marginal cross vein lies at a less distance beyond the base of the first submarginal cell than the length of the petiole of that cell. The third longitudinal vein is abruptly bent a little beyond its base where the cross vein strikes it, and the second submarginal and first posterior cells are subequal in length and fully as long as the breadth of the wing. The petiole of the second posterior cell is shorter than the cell. The discal cell is about twice as long as broad, subequal and a little shorter than the posterior cells beyond it. The

great cross vein strikes the middle of the discal cell, and the fifth posterior cell is hardly twice as long as broad. There is a distinct supplementary cross vein in the middle of the second basal cell, lying outside a point opposite the base of the præfurca. The legs are relatively stout, the femora apically blackened.

Length of wings, 6.5 mm. ; breadth, 2.25 mm. ; length of fore femora, 3.5 mm. ; tibiæ, 4.75 mm. ; tarsi, 4.6 mm. ; mid femora, 3.75 mm. ; tibiæ, 4.75 mm. ; hind femora, 4.6 mm. ; tibiæ, 5 mm.

Florissant, Colorado. One specimen, Nos. 7954 and 10399.

Cladura integra.

Pl. 4, fig. 8.

Wings almost four times as long as broad, hyaline and immaculate except for the faintest possible infumation on the stigma. The auxiliary vein ends but little before the middle of the apical half of the wing, between the origin of the third longitudinal vein and the base of the first submarginal cell ; the subcostal cross vein lies but a short distance from the tip of the auxiliary vein. The præfurca arises at about the middle of the wing, is arcuate at base, beyond straight, divergent and rather distant from the first longitudinal vein, and is distinctly shorter than the rest of the vein. The marginal cross vein lies as far beyond the base of the first submarginal cell as the length of its petiole. The third longitudinal vein is not bent at the base, the cross vein uniting it to the branch of the fourth longitudinal vein meeting it at the very base ; consequently the second submarginal and first posterior cells are equal in length, and they are much longer than the breadth of the wing. The petiole of the second posterior cell is very much shorter than the cell, the discal cell is less than twice as long as broad, equal and hardly more than half as long as the posterior cells beyond it. The great cross vein strikes the discal cell near its base and the fifth posterior cell is several times longer than broad and equal, the fifth longitudinal vein being hardly bent. Legs very slender. The sides of the abdomen are distinctly darker than the dorsum.

Length of wings, 10.5 mm. ; breadth, 2.6 mm. ; length of fore femora, 5.5 mm. ; tibiæ, 6.75 mm. ; tarsi, 6.25 mm. ; hind femora, 6 mm. ; tibiæ, 7.5 mm. ; tarsi, 6 mm.

Florissant, Colorado. One specimen, No. 1590.

Tribe LIMNOPHILINI.

This is the most important tribe among the Limnobiinæ whether living or fossil. Five genera and twenty-five species have been recognized among the fossils, though only a very few of the European species are described or figured. Three or more species each of *Limnophila*, *Trichocera*, *Tanymera*, and *Trichoneura*—the last two extinct genera—have been recorded from the European tertiaries, besides one of the extinct genus *Calobamon*; these are all from amber except a single species each from Aix and Locle, belonging to *Trichocera*. From America only four species of *Limnophila* are known.

LIMNOPHILA Macquart.

Limnophila Macq., *Hist. Nat. Dipt.*, i, 95 (1834).

Limnophila is a prolific north temperate genus with numerous species both in North America and in Europe, in each of which about thirty species are known. In North America it occurs across the continent and from Alaska to Mexico, and it is also found in South America.

In his first studies upon this group, Osten Sacken suggested the use of several subgeneric names, which he proposed in a tentative manner, to be used until a complete revision of the genus could be made. In later writings he has still further subordinated these, which are in part founded upon minor points in the neuration of the wings. The examination of the few fossils of this group from Florissant seems to emphasize his later judgment, since we find several species with a cross vein in the first submarginal cell (one of the characteristics of his subgenus *Dicranophragma*), but which do not well agree in other features of *Dicranophragma*, while one of them has a supplementary cross vein in the costal area, as in *Epiphragma*—a group which he later regards as of generic value. It has seemed best, therefore, pending a complete revision of the *Limnophilæ* of the world, to use for these fossil species only the broader generic name *Limnophila*. It is a striking fact that of the four species known (each, unfortunately, by only a single example) three should have only four posterior cells, and three should have a supplementary cross vein in the first submarginal cell, both these features being rare in modern *Limnophilæ*.

Numerous fossil species of this group have been found in Europe, but only in Prussian amber, where the variety of forms is so great that Loew placed them in no less than four of his proposed new genera, and did not recognize among them at all the typical *Limnophilæ*. These genera were *Trichoneura*, *Critoneura*, *Tanymera*, and *Tanysphyra*, with eleven species; and besides these Osten Sacken refers his species of *Cylindrotoma*, four in number, to this group. The species described below, which are the first found in rock deposits, may be separated as follows:

Table of the Species of Limnophila.

First submarginal cell with a supernumerary cross vein.

A supplementary cross vein in the costal area, next the base of the præfurca.
rogersii.

No cross vein in costal area.

Larger species, possessing only four posterior cells *vasta.*

Smaller species, with five posterior cells. *strigosa.*

First submarginal cell with no supernumerary cross vein. *ruinarum.*

Limnophila rogersii.

Pl. 4, fig. 3.

Wings hyaline with fuscous veins and no sign of a stigma. Auxiliary vein ending opposite the base of the first submarginal cell, the subcostal cross vein at its tip; a supernumerary cross vein in the costal area, opposite the base of the præfurca. First longitudinal cross vein ending about midway between the tip of the auxiliary vein and the apex of the wing. Præfurca arising about the middle of the wing, rather strongly arcuate at base, straight beyond, two thirds as long as the rest of the vein. Marginal cross vein just beyond the tip of the auxiliary vein and opposite the base of the first submarginal cell, which has a supernumerary cross vein a little beyond its middle. Apparently only four posterior cells, but by the folding and overlapping of the wings in the only example known, this point is not entirely clear; the same disturbance prevents any statement regarding the discal cell. Legs very slender and long, the tibiæ apically spurred.

Length of wings, 6.5 mm.; fore femora, 3.5 mm.; tibiæ, 4.5 mm.; tarsi, 3.75 mm.; mid femora, 4 mm.; tibiæ, 5 mm.; tarsi, 5.25 mm.; hind femora, 4.8 mm.; tibiæ, 5.25 mm.

Named in memory of Prof. H. D. Rogers, formerly state geologist of Pennsylvania.

Florissant, Colorado. One specimen, No. 13732.

Limnophila vasta.

Pl. 4, fig. 7.

Wings very faintly infumated, with a faint and small fuscous stigma. Auxiliary vein ending opposite the base of the first submarginal cell. First longitudinal vein continuing far toward the apex of the wing, being apically deflected with the margin. Præfurca arising at a little distance before the middle of the wing, considerably arcuate at base, beyond straight and gently divergent from the first longitudinal vein, as long as the end of the vein beyond the marginal cross vein, which is a little beyond the tip of the auxiliary vein and oblique. First submarginal cell with a supernumerary cross vein in the middle of its apical half. Four posterior cells. Discal cell short relative to the posterior cells beyond it, which are very long. The specimen is a male, and the antennæ are very long as in the subgenus *Idioptera*, but whether there is a supernumerary cross vein in the second basal cell cannot be determined. The legs are not preserved. It is the largest of the fossil species.

Length of wings, 11.75 mm.

Florissant, Colorado. One specimen, No. 7021.

Limnophila strigosa.

Pl. 4, fig. 5.

Wings uniformly and very faintly infumated, with no sign of a stigma. Auxiliary vein long, extending slightly beyond the base of the præfurca and the apex of the wing, the subcostal cross vein at its tip. First longitudinal vein extending far toward the tip of the wing, but scarcely declivent apically. Præfurca arising a little before the middle of the wing, gently arcuate throughout, two thirds as long as the first submarginal cell. Marginal cross vein as far beyond the base of the first submarginal cell as that from the origin of the third longitudinal vein, oblique. First submarginal cell with a supernumerary cross vein near its apex. Five posterior cells, the second petiolate, apparently longer than its petiole. The discal cell and parts below obscured by the folding of

the wing in the only specimen known. Legs slender, not very long, the tibiæ distinctly spurred at apex.

Length of wings, 6.25 mm. ; hind tibiæ, 2.75 mm.

Florissant, Colorado. One specimen, No. 8178.

Limnophila ruinarum.

Pl. 4, fig. 6.

Wings very faintly and uniformly infumated, with no stigma. The front margin of both wings is imperfect, not permitting the auxiliary vein to be fully traced ; but it is probably rather short, as the first longitudinal vein ends about opposite the middle of the first submarginal cell. The præfurca is very long, arising before the end of the basal third of the wing, is gently arcuate at base, straight thereafter, and nearly as long as the rest of the vein, which is exceptionally arcuate. Marginal cross vein oblique, further from the base of the first submarginal cell than it is from the origin of the third longitudinal vein ; this cell without any supplementary cross vein. Four posterior cells. The discal cell pointed at base, and though by this made longer, it is not much more than half as long as the second posterior cell. The great cross vein strikes the middle of the discal cell, and the fifth longitudinal vein is slightly bent where met by it. No supplementary cross vein in the second basal cell. Legs not very slender and relatively shorter than in the other fossil species, the tibiæ with apical spurs. Abdomen dark above, light below.

Length of wings, 8.25 mm. ; hind femora, 4.25 mm. ; tibiæ, 5.5 mm.

Florissant, Colorado. One specimen, No. 9575.

PRONOPHLEBIA Scudder.

Pronophlebia Scudd., *Bull. U. S. Geol. Geogr. Surv. Terr.*, iii, 750 (1877);
Tert. Ins. N. A., 573-574 (1891).

This genus was established upon a single imperfect specimen, in which the third appeared to rise from the second longitudinal vein almost immediately after the separation of the latter from the first longitudinal vein, and so was very different from its origin in any other group of *Limnobiinæ*. Renewed examination of the specimen does not enable me to contradict this interpretation of the fossil,

although it appears very improbable. I accordingly leave it until more perfect material shall enable some one to correct or verify it and fill out the remainder of the neurulation. It is, therefore, placed at the end of the series, as it is quite impossible to tell in what tribe it should fall.

Pronophlebia rediviva.

Pronophlebia rediviva Scudd., *Bull. U. S. Geol. Geogr. Surv. Terr.*, iii, 750-751 (1877); *Tert. Ins. N. A.*, 574, pl. 5, fig. 39 (1891).

White River, near the boundary of Colorado and Utah.

VIII. THE SUBFAMILY TIPULINÆ.

The fossil representatives of this subfamily are, relatively to the Limnobiinæ, just about as numerous in the European deposits as in the present fauna of Europe or of America, being in each case about half as numerous as they; but in the American rocks, and still more in the European rock deposits (*i. e.*, exclusive of amber), they hold a much more important place. In tertiary Europe nine species of *Tipula*, one of *Ctenophora*, and two of *Tipulidea* (an extinct genus) have been described, and the presence of about fifteen other species of *Tipula* indicated, besides a *Nephrotoma*; while in North America, seventeen species of *Tipula* (including those in the present essay) have been described, and four species of *Tipulidea*, an extinct genus, besides single species of three other extinct genera. The tertiary fauna appears therefore to be somewhat more diversified in this subfamily in America than in Europe.

I have used here the terms employed by Osten Sacken for the neurulation of the wings, but the neurulation of these fossils seems to render it probable that what he calls (*Monogr. Dipt. N. A.*, iv, 290) the anterior branch of the apical fork of the second longitudinal vein is really the termination of the first vein itself, which is connected by a cross vein to the second, where it approaches it. This last would then be a "marginal" cross vein, and the fact that no other marginal cross vein ever exists in the Tipulinæ lends greater probability to this view, which would bring the structure into better accordance with that of many Limnobiinæ.

The American genera of fossil Tipulinæ may be separated by the following table:

Table of the Genera of American Fossil Tipulinæ.

- a¹. Last posterior cell in contact with the discal cell; the latter of moderate size.
- b¹. Anterior branch of fourth longitudinal vein unforked, or very feebly forked.....*Manapsis*.
- b². Anterior branch of fourth longitudinal vein strongly forked.
- c¹. Posterior branch of fourth longitudinal vein doubly forked, so that there are six posterior cells.....*Rhadinobrochus*.
- c². Posterior branch of fourth longitudinal vein simply forked, so that there are five posterior cells.
- d¹. Præfurca nearly as long as, as long as, or longer than, the width of the first and second basal cells together, opposite the origin of the præfurca.....*Tipula*.
- d². Præfurca not, or scarcely, longer than the greatest width of the first basal cell.....*Tipulidea*.
- a². Last posterior cell not in contact with the discal cell; the latter minute.
Micrapsis.

MANAPSIS (*μανῶς, ἀψίς*) gen. nov.

This name is here given to a genus of crane-flies closely allied to *Tipula*, in which the second posterior cell does not exist, or if it does, exists only as an exceedingly small and slender cell formed by the apical and very slight forking of the upper branch of the fourth longitudinal vein. In the single specimen known it forks thus upon one wing and not at all upon the other; the latter would appear to be the normal condition to judge from the weak character of the fork upon the other wing. So far as I can discover, no such condition is known to exist elsewhere among the *Tipulinæ*, and I accordingly suggest the separation of this form as a distinct genus. In all other respects the neuration agrees with that of *Tipula* and *Ctenophora*, and the legs appear to be much as in *Tipula*. The markings of the abdomen seem to be peculiar, for they consist of a very broad pale mediodorsal stripe on an otherwise dark abdomen.

A single species is known.

Manapsis anomala.

Pl. 5, fig. 1.

Wings almost four times as long as broad, uniformly infumated, with a distinct very dark stigma. Auxiliary vein terminating at the middle of the inner marginal cell; poststigmatal cross vein rather brief, slightly oblique; trapezoidal cell brief. Præfurca a little

longer than the width of the first and second basal cells together at its base. Lowest posterior cell much wider at base than at margin ; discal cell of medium size, about twice as long as broad. Sixth longitudinal vein moderately approximated to the fifth ; seventh longitudinal vein distinctly less than half as long as the wing. Abdomen very dark, with a broad pallid mediodorsal stripe. Legs slender, the tibiæ distinctly slenderer than the femora, which are three fifths as long as the wings.

Length of wings, 14.75 mm. ; of mid femora, 9 mm.

Florissant, Colorado. One ♀ specimen, No. 8200.

RHADINOBROCHUS (*ῥαδινὸς, βρόχος*) gen. nov.

It is with some hesitation that I propose the above name, as the single object upon which it is based is so imperfect. But the portion that is well preserved is so anomalous, while preserving in most of its features the exact neuration of *Tipula*, that it can hardly be properly treated excepting under a distinct generic name. These peculiarities consist of two features : the extraordinary slenderness of the discal cell, and the presence of a supplementary posterior cell by the longitudinal division with slightly unequal but symmetrical halves of the third posterior cell by an additional nervule, running from the discal cell to the margin.

A single species is known.

Rhadinobrochus extinctus.

Pl. 5, fig. 4.

Wings nearly four times as long as broad, uncolored except for the rather faint stigma at the extremity of the inner marginal cell. Auxiliary vein terminating at the middle of this cell ; poststigmatal cross vein slightly oblique, moderately long ; trapezoidal cell not much elongated. Præfurca of normal length. Petiole of second posterior cell about half as long as the discal cell ; third posterior cell broken into two, as described under the genus ; last posterior cell not much wider at base than at margin. Discal cell broadest basally, tapering throughout, of the usual length in species of *Tipula*, but four times as long as its basal breadth, not in close contact with the last posterior cell. Sixth longitudinal vein moderately near the fifth. Legs slender, the femora fully three fifths the length

of the wings. Abdomen with a dark dorsal stripe on a pale ground.

Length of wings, 13.5 mm. ; hind femora, 8.5 mm.

Florissant, Colorado. One ♂ specimen, No. 8847.

TIPULA Linné.

Tipula Linn., *Syst. Nat.*, ed. i (1735).

This is a cosmopolitan genus with an enormous number of species, found in every quarter of the world, but most numerous in north temperate countries. Sixty-seven species have been credited to North America from Greenland to Mexico, and no less than eighty-eight to Europe. Fossil remains of this genus have also frequently been credited to different deposits in Europe, as at Sieblos, Oeningen, and Brunstatt in Germany, Aix in France, Gabbro and Chiavon in Italy, and the Krottensee in Bohemia, besides numerous examples at Radoboj in Austria and in Prussian amber. From the former of these last two deposits half a dozen species are described and figured, while in amber Loew has recognized from eleven to sixteen species, none of them yet described. In a very few instances the fossil species referred to *Tipula* can be shown to belong elsewhere, but most of them can be assumed to be true *Tipulæ*. In America we have already found seventeen species, most of them at Florissant, the remainder in the Gosiute fauna at Green River, Wyoming.

The greater number, both of individuals and species, of the Florissant *Tipulinæ* belong to the genus *Tipula* in the strictest sense. I have been unable to discover any constant and pervading differences to distinguish them from existing forms, but have separated on one side and the other certain species which show marked individual characteristics, sometimes in unexpected and rather surprising features; and have besides divided the genus in the following table into two groups by the length of the præfurca, the extreme brevity of which in certain species closely allied to *Tipula* has induced me to separate them as a distinct genus, *Tipulidea*. The species with relatively short præfurca, which I leave in *Tipula*, seem to agree in this particular with the existing Mexican species, *T. edwardsii*, figured by Bellardi.

Two fossil species formerly described by me as *Tipulæ* (under the names *Tipula decrepita* and *Tipula tecta*) are certainly not *Tipu-*

linæ and most probably belong to *Dicranomyia* (*g. v.*). Excluding therefore these two, the species of *Tipula* found fossil in America may be separated by the following table :

Table of the Species of Tipula.

- A¹. Præfurca relatively long, as long as, generally longer than, the breadth of the first and second basal cells together next its base ; or, half as long as the intersected apical area of the wing beyond the basal cells.
- b¹. Wings immaculate except at stigma.
- c¹. Markings of the abdomen linear and light.
- d¹. Wings exceeding 28 mm. in length.....*magnifica*.
- d². Wings less than 26 mm. in length.
- e¹. Wings 21 mm. or more in length.....*rigens*.
- e². Wings between 16 and 21 mm. in length....*florissanta*.
- e³. Wings less than 16 mm. in length.
- f¹. Discal cell fully twice as long as broad.....*clauda*.
- f². Discal cell less than twice as long as broad.*sepulchri*.
- c². Markings of the abdomen oblique and heavy.
- d¹. Larger species, the wing length exceeding 20 mm. *revivificata*.
- d². Smaller species, the wing length less than 17 mm. *evanitura*.
- b². Wings maculate or discolored along the veins.
- c¹. Abdomen with transverse markings.....*maclurei*.
- c². Abdomen with longitudinal markings.
- d¹. Larger forms, the wings exceeding 19 mm. in length.
- e¹. Præfurca of ordinary length, not much exceeding the breadth of the first and second basal cells together, next its base ; wings relatively slender, nearly or quite four times as long as broad.*heilprini*.
- e². Præfurca exceptionally long, exceeding the breadth next its base of the combined first and second basal and anal cells ; wings relatively broad, not exceeding three and a half times their breadth.....*tartari*.
- d². Smaller forms, the wings not reaching a length of 19 mm.
- e¹. Wings not more than four times as long as broad.
- f¹. Discal cell relatively short and broad, less than twice as long as broad ; petiole of second posterior cell relatively long, much more than half as long as the cell.
carolinæ.
- f². Discal cell relatively long and narrow, at least twice as long as broad ; petiole of second posterior cell relatively short, not more, generally much less, than half as long as the discal cell.*limi*.
- e². Wings more than four times as long as broad. *internecata*.

- A². Præfurca relatively short, distinctly shorter than the breadth of the first and second basal cells together, next its base ; or, much less than half the length of the intersected apical area of the wing beyond the basal cells.
- b¹. Species of larger size, with wings at least 17 mm. long, the auxiliary vein stopping far short of the middle of the inner marginal cell. *subterjacens*.
- b². Species of smaller size, with wings less than 17 mm. long, the auxiliary vein reaching the middle of the inner marginal cell.
- c¹. Præfurca contained about two and a half times in the length of the intersected apical area of the wing beyond the basal cells.
- d¹. Larger forms; the margin of some of the veins discolored. *lethæa*.
- d². Smaller forms; some of the principal veins discolored (in some obscure specimens, this discoloration may be wholly or partially obliterated). *lapillescens*.
- c². Præfurca only one third the length of the intersected apical area of the wing beyond the basal cells. *spoliata*.

Tipula magnifica.

Pl. 5, fig. 3.

Wings slightly more than four times as long as broad, uncolored except for the faint stigma. Auxiliary vein terminating at some distance before the middle of the inner marginal cell; poststigmatal cross vein (uniting the first and second longitudinal veins) oblique and moderately long; trapezoidal cell elongate. Præfurca of normal length. Second posterior cell more than twice as long as its petiole. Middle branch of the fourth longitudinal vein gently arcuate, making the third posterior cell apically narrower than the fourth. Discal cell not very large, less than twice as long as broad. Sixth longitudinal vein distant from the fifth. Legs moderately slender, the femora distinctly stouter than the tibiæ and very slightly more than half as long as the wings, the tibiæ a very little longer than the femora, and the middle tarsi nearly two fifths longer than the tibiæ. Abdomen light colored, with slender median and broad lateral darker stripes.

This is by far the largest fossil Tipulid known, but is not so large as some modern species.

Length of wings, 29.5–30 mm.; fore femora, 15.5 mm.; tibiæ, 18.5 mm.; mid femora, 15.5 mm.; tibiæ, 18 mm.; tarsi, 24.5 mm.; hind femora, 16.5? mm.; tibiæ, 19.75 mm.

Florissant, Colorado. Three ♀ specimens, Nos. 5481, 12107, 16310 and 16311.

Tipula rigens.

Pl. 5, fig. 5; pl. 6, figs. 1, 3.

Wings four or slightly less than four times as long as broad, uncolored, except for the rounded stigma which is situated above the proximal half or more of the discal cell and is denser on its distal than its proximal side. Auxiliary vein terminating at the middle of the inner marginal cell; poststigmatal cross vein slightly oblique and moderately long (it is given too short in pl. 5, fig. 5); trapezoidal cell brief. Præfurca of normal length. Petiole of second posterior cell varying from about half as long as the discal cell to nearly its length. Fifth posterior cell much broader at base than at margin. Discal cell of moderate size, nearly twice as long as broad. Sixth longitudinal vein moderately distant from the fifth; seventh longitudinal vein much shorter than half the length of the wing. Femora moderately stout, distinctly stouter than the slender tibiæ, half or almost half as long as the wings, the tibiæ a little longer than the femora, and the tarsi of the fore pair one third, of the mid pair nearly one half longer than the tibiæ. Abdomen light colored and, when not obscured, with median and marginal narrow dark stripes, and occasionally with a feebler intermediate stripe on either side.

Length of wings, 21–25 mm.; fore femora, 11 mm.; tibiæ, 13.5 mm.; tarsi, 18.5 mm.; mid femora, 11 mm.; tibiæ, 12 mm.; tarsi, 18.5 mm.; hind femora, 11.5 mm. The measurements of the legs are all from one ♂, having a wing length of about 22 mm.

Florissant, Colorado. Fifteen specimens, all but one (with the possible exception of a second) females; Nos. 1638, 8061, 8088, 8477, 10427, 11332, 11669, 11677, 11805, 12105 and 12106, 12561, 13714, 16314 of my collection; No. 14699 collected by Miss C. H. Blatchford; No. 1.793 of the Princeton collection.

Tipula florissanta.

Pl. 5, fig. 2; pl. 6, figs. 4, 5; pl. 7, fig. 1.

Wings almost exactly four times as long as broad, uncolored except for the rounded obovate stigma situated over the proximal two thirds of the discal cell. Auxiliary vein terminating at the

middle of the inner marginal cell; poststigmatal cross vein slightly oblique and rather short, trapezoidal cell moderately elongate. Præfurca of normal length. Petiole of second posterior cell short, rarely exceeding, seldom equaling half the length of the discal cell, in one instance (No. 1697) barely one third its length; fifth posterior cell much broader at base than at margin. Discal cell fairly large, elongate, arcuate, more than twice as long as broad; it varies in one specimen which seems to belong here (No. 8944), in being straighter and exceptionally slender, being fully three times as long as broad. Sixth longitudinal vein moderately near the fifth, but slightly variable, usually nearer than in *T. rigens*, but occasionally as distant; seventh longitudinal vein nearly or very nearly half as long as the wing. Legs slender, the femora not greatly stouter than the tibiæ and considerably more than half as long as the wings, the tibiæ distinctly longer than the femora, except the middle pair, which is subequal to them; the tarsi subequal and fully half as long again as the tibiæ. Abdomen pale beneath, above light colored with a rather narrow dark median stripe and a pair of similar but generally more conspicuous lateral stripes, nearer the lateral margins than the middle line, unless the abdomen is inflated, as when heavy with eggs, when they may recede farther from the margin, as seen from above.

Length of wings, 16–20.5 mm.; of legs in one specimen, No. 13685, in which all the legs are perfectly preserved and the wing measures 17 mm. long, as follows: fore femora, 10 mm.; tibiæ, 12 mm.; tarsi, 18.5 mm.; mid femora, 11.5 mm.; tibiæ, 11 mm.; tarsi, 18.5 mm.; hind femora, 11 mm.; tibiæ, 13.5 mm.; tarsi, 19.5 mm.

Florissant, Colorado. Fifty-one specimens, of which ten are ♂, the remainder ♀ or indeterminate; Nos. 92, 775, 883 and 1692, 1617, 1697 and 7732, 2161, 2780, 3267, 3685, 4435, 4618, 5545, 5595, 6060, 7220, 7721, 8185, 8210, 8390, 8538 and 11676, 8821, 8858, 8944, 9040, 9261, 9857, 10386, 10634, 11137, 11334, 11338, 11339, 11667, 11812, 11845, 12142, 12715, 13273, 13280 and 13296, 13281, 13685, 13694, 13724, 13985, 14004, 14995, 16312 from my collection; also Nos. 1481, 1502 U. S. Geological Survey; No. 16420 collected by R. Thaxter; and 1.750 from the Princeton collection.

Tipula clauda.

Pl. 6, fig. 2; pl. 7, figs. 2-4.

Wings about four times as long as broad, generally a trifle less than more, uncolored except for the generally distinct and rather small stigma. Auxiliary vein terminating at the middle or scarcely beyond the middle of the inner marginal cell; poststigmatal cross vein transverse or scarcely oblique, rather short; trapezoidal cell rather elongate. Præfurca of normal length. Petiole of second posterior cell generally rather short, rarely exceeding half the length of the discal cell, but sometimes slightly longer than that; fifth posterior cell somewhat, sometimes considerably, broader at base than at margin. Discal cell not very large, elongate, fully twice as long as broad. Fourth longitudinal vein usually running slightly nearer the first than the fifth longitudinal vein, the sixth longitudinal vein moderately approximated to the fifth; seventh longitudinal vein as in *T. florissanta*. Legs slender, the tibiæ considerably slenderer than the femora, the hind femora slightly longer than the others and nearly two thirds as long as the wings, the tibiæ and especially the fore pair distinctly longer than the femora, and the tarsi more than half as long again as the tibiæ. Abdomen light colored, with a dark median longitudinal stripe, sometimes obscure and generally rather broad, and pretty uniformly distinct and equally broad dark lateral stripes—all occasionally obscured in preservation.

Length of wings, 12-15.5 mm.; of legs in one specimen (No. 3820) where the wing measures 15 mm. in length, as follows: fore femora, 9 mm.; tibiæ, 11.2 mm.; tarsi, 17.7 mm.; mid femora, 9 mm.; tibiæ, 10 mm.; hind femora, 9.7 mm.; tibiæ, 11 mm.; tarsi, 17 mm.

Florissant, Colorado. Thirty-four specimens, of which 7 are ♂, the rest ♀ or uncertain; Nos. 88, 100, 649, 989, 1038, 1205 and 3396, 1356, 3003, 3307, 3368 and 11671, 3570 and 5329, 3820 and 4974, 4634, 4664, 6910, 8057, 8195, 8478, 8873, 8899, 10659, 10683, 11336, 11337, 12623, 13066, 13118, 13229, 13260, 13266, 14118, 14169 of my collection; Nos. 1.753, 1.756 of the Princeton collection.

Tipula sepulchri.

Tipula sepulchri Scudd., *Tert. Ins. N. A.*, 578, pl. 10, fig. 1 (1891).

This species differs from the preceding, *T. clauda*, principally in the brevity of the discal cell.

Green River, Wyoming.

Tipula revivificata.

Wings fully four times as long as broad (the exact width cannot be measured), uncolored except for the greatly enlarged stigma and a slight infuscation on the middle of the fourth longitudinal vein. Auxiliary vein terminating slightly before the middle of the inner marginal cell; poststigmatal cross vein scarcely oblique, rather short; trapezoidal cell rather brief. Præfurca of normal length. Second posterior cell obscure but apparently as in *T. magnifica*. Discal cell rather small, apparently about twice as long as broad; remainder of neuration obscure. Legs slender, the femora but slightly stouter than the tibiæ and a little more than half as long as the wings. Abdomen dark, with oblique light markings midway between the middle and the lateral margins, becoming longitudinal on the first two segments, the middle dark markings on the third to the seventh abdominal segments being subtriangular elongate patches, having a rude and rounded **T** shape, the cross bar of the **T** short and rounded.

Length of wings, 21 mm.; mid femora, 11 mm.; hind femora, 12.5 mm.

Florissant, Colorado. One ♀ specimen, No. 9119.

Tipula evanitura.

Wings with the same proportions as in *T. clauda*, and as there without markings except the distinct and rather small obovate stigma. Auxiliary vein terminating at the middle of the inner marginal cell; poststigmatal cross vein transverse and rather short; trapezoidal cell rather more than usually elongate. Præfurca of normal length. Petiole of second posterior cell brief, hardly more than a fourth as long as the discal cell; fifth posterior cell subequal throughout. Discal cell moderately large, elongate, considerably more than twice as long as broad. Fourth longitudinal vein running scarcely nearer the first than the fifth longitudinal vein, the sixth longitudinal vein moderately distant from the

fifth. Legs slender, the tibiæ distinctly more so than the femora, the latter nearly or quite three fifths as long as the wings, the tibiæ distinctly, though but little, longer than the femora, the tarsi nowhere completely preserved. Abdomen with a light-colored ground with dark markings, which are not wholly linear, but consist, first, of a series of short and rather stout, briefly linear dashes along the middle of the dorsum, or an interrupted stripe; and next, of oblique oval lateral patches on each segment, deepest anteriorly, and posteriorly more or less blending with the median stripe.

Length of wings, 14.25-16 mm.; fore femora, 8-9 mm.; tibiæ, —?—10.75 mm.; mid femora, 8.75-9.5 mm.; hind femora, 9- —? mm.; tibiæ, 9.75- —? mm.

Florissant, Colorado. Two ♀ specimens; No. 8588 of my collection; No. 1.760 of the Princeton collection.

Tipula maclurei.

Pl. 7, fig. 6.

Wings nearly four times as long as broad, with a dark and rather large oblong stigma and many of the veins broadly discolored with dark fuliginous, which forms patches or clouds in places; in particular, the fifth longitudinal vein (with the great cross vein) is heavily bordered, though interrupted by pallid clouds just before and just after the middle of the wing; a brief slender dark patch descends from the stigma, and is separated from the fuscous clouds beyond by pallid clouds which intervene in the discal cell and all the cells above it; except as it nears the discal cell, the fourth longitudinal vein is unstained though faint slender fuliginous streaks follow the first and second basal cells. Auxiliary vein terminating at the middle of the inner marginal cell; post-stigmatal cross vein transverse, brief; trapezoidal cell rather short. Præfurca of normal length. Petiole of second posterior cell not more than half as long as the discal cell; fifth posterior cell but little broader at base than at margin. Discal cell rather small and brief, not more than half as long again as broad. Sixth longitudinal vein distant from the fifth; seventh longitudinal vein less than half as long as the wing. Legs relatively stout, the tibiæ considerably slenderer than the femora and a little longer than they, the femora less than three fifths the length of the wings, and the tarsi apparently not greatly longer than the tibiæ. Abdomen pale

beneath; above covered heavily with dark transverse markings, consisting on each of the principal segments of a broad bow, open anteriorly, and a couple of subconfluent or confluent median rounded spots united therewith, these leaving a pair of anterior laterodorsal pallid spots and the outer posterior corner of each segment pallid; the markings become confused on the basal and apical segments, the latter of which are wholly dark.

Named in memory of the early American naturalist, William Maclure.

Length of wings, 23 mm.; fore and mid femora, 10.5 mm.; fore and mid tibiæ, 12 mm.; mid tarsi, 15 mm.; hind femora, 13 mm.

Florissant, Colorado. One ♀ specimen, No. 7783.

Tipula heilprini.

Pl. 8, fig. 2.

Wings nearly four times as long as broad, with generally very faint, occasionally tolerably distinct clouded dark markings disposed much as in *T. maclurei*, and brought into relief by similarly faint pallid markings above the discal cell. Auxiliary vein terminating at the middle of the inner marginal cell; post-stigmatal cross vein slightly oblique, brief; trapezoidal cell moderately elongate. Præfurca of normal length. Petiole of second posterior cell short, not more, generally much less, than half the length of the discal cell; fifth posterior cell generally, but not always, considerably broader at base than at margin, the sides straight. Discal cell of medium size, twice as long as broad. Sixth longitudinal vein moderately distant from the fifth; seventh longitudinal vein half as long as the wing. Legs very slender, the femora about three fifths the length of the wings, and stouter than the tibiæ, which slightly exceed them in length; while the tarsi, or at least the fore tarsi, are but a little more than a fourth longer than the tibiæ. Abdomen light colored, with dark linear markings somewhat variable in their width; in general there is a median and, on either side, a lateral stripe, with another midway between them or approaching one or the other; and excepting the subdorsal stripes, which are sometimes hardly seen and always slender when present, the others may vary in breadth; the incisures also are infuscated.

Named for Prof. Angelo Heilprin, of Philadelphia, whose work on tertiary fossils is well known to all naturalists.

Length of wings, 20–23 mm. ; length of legs, in a specimen whose wing is 22.5 mm. long, as follows: fore and mid femora, 12.75 mm. ; fore and mid tibiæ, 14 mm. ; fore tarsi, 18 mm. ; hind femora, 13 mm. ; tibiæ, 14 mm.

Florissant, Colorado. Eight ♀ specimens; Nos. 3596, 4425, 4761, 7809, 11670, 11806, 13114 and 14101, 13725.

Tipula tartari.

Pl. 8, fig. 1.

Wings scarcely three and a half times longer than broad, faintly infuscated throughout but more deeply in places, such as the inner and outer margins of large pallid patches found crossing the wing (bounded above and below by the first and fifth longitudinal veins), the apical portion just beyond the stigma, and the narrowing infuscated patch depending from it; a similar pallid patch occupies the middle half of the inner marginal cell; the veins are very narrowly infuscated throughout. Auxiliary vein terminating at the middle of the inner marginal cell; poststigmatal cross vein transverse, moderately long; trapezoidal cell rather elongate. Præfurca of exceptional length, exceeding the breadth of the first and second basal cells at its base, together with the anal cell, or three fourths the breadth of the unusually broad wings. Petiole of second posterior cell very short, scarcely a quarter the length of the discal cell; fifth posterior cell subequal in breadth. Discal cell rather large, about twice as long as broad. Sixth longitudinal vein rather distant from the fifth; seventh longitudinal vein hardly half as long as the wing. Legs moderately slender, the tibiæ not much slenderer and not much longer than the femora, and these scarcely more than half as long as the wings. Abdomen light colored, with rather slender mediodorsal and lateral dark stripes.

Length of wings, 20.75 mm. ; fore femora, 10 mm. ; tibiæ, 10.5 mm. ; mid and hind femora, 10.75 mm.

Florissant, Colorado. One ♀ specimen, No. 12109.

Tipula carolinæ.

Pl. 7, fig. 5.

Wings almost exactly four times as long as broad, with dark markings, besides the distinct ovate stigma, consisting of scarcely

more than an infuscation of the zigzag veins crossing the wing below the stigma, the margination of the apical half of the fifth longitudinal vein, and in a less degree of all the apical veins, but brought slightly into relief by a pallid cloud above and partially including the discal cell; in one of the two specimens these markings are very faint. Auxiliary vein terminating barely before the middle of the inner marginal cell; poststigmatal cross vein transverse, moderately short; trapezoidal cell not much elongated. Præfurca of normal length. Petiole of second posterior cell relatively long, much more than half the length of the discal cell; fifth posterior cell considerably broader at base than at margin. Discal cell relatively short and broad, less than twice as long as broad, rather small. Sixth longitudinal vein rather distant from the fifth; seventh longitudinal vein less than half as long as the wing. Legs slender, the tibiæ but slightly slenderer than the femora and a little longer than they, while the femora are but little more than half as long as the wings. Abdomen with rather broad mediodorsal and lateral dark stripes.

Length of wings, 15.5–17.5 mm.; of legs, in the smaller specimen, as follows: fore femora, 8.5 mm.; mid femora, 7.5? mm.; hind femora, 9 mm.; tibiæ, 9.75 mm.

Florissant, Colorado. Two ♀ specimens; Nos. 7298, 14715, the latter collected by Miss Caroline H. Blatchford, for whom the species is named.

Tipula limi.

Pl. 8, fig. 4; pl. 9, fig. 1.

Wings four or a little less than four times as long as broad, the stigma moderately large, rounded, distinct, followed beneath by a small deeply infuscated patch at the base of the submarginal and first posterior cells, often as a triangular dependence of the stigma and as deeply stained as it; besides this, dark markings occur all over the wing, disposed much as in *T. maclurei*, but without the pallid clouds, or at most but extremely faint ones, and with the addition of a dark cloud at the base of the præfurca; the markings vary much in breadth and in depth of coloring in different individuals, but are generally as in the specimens figured. Auxiliary vein terminating at or scarcely before the middle of the inner marginal cell; poststigmatal cross vein transverse, brief; trapezoidal

cell rather elongate. Præfurca of normal length. Petiole of second posterior cell relatively short, not more, generally much less, than half as long as the discal cell; fifth posterior cell usually much broader at base than at margin. Discal cell relatively long and narrow, at least twice as long as broad. Sixth longitudinal vein pretty closely approximated to the fifth; seventh longitudinal vein much less than half as long as the wing. Legs slender, the femora only a little more than half as long as the wings, and scarcely stouter than the tibiæ, which barely exceed them in length. Abdomen with moderately broad and similar mediodorsal and lateral dark stripes.

Length of wings, 16–19 mm.; of legs in a specimen of largest size: femora, 10 mm.; fore and mid tibiæ, 10.5 mm.; hind tibiæ, 10.3 mm.

Florissant, Colorado. Twelve specimens, of which two are ♂, one indeterminate, the remainder ♀; Nos. 1611, 1892, 2839, 5206, 5544, 5584, 7786, 8166, 8170, 8479, 13759 of my collection; No. 1.788 of the Princeton collection.

Tipula internecata.

Wings nearly four and a half times longer than broad, the stigma rather small and followed below by a dark fuliginous patch, as in the preceding species, the veins discolored along their edges, and occasionally, and especially at and beyond the middle of the fourth longitudinal vein, enlarging into discolored cloudy patches separated by the faintest possible pallid cloud; similar pallid clouds occupy the discal and fifth posterior cells. Auxiliary vein attaining the middle of the inner marginal cell; poststigmatal cross vein transverse, moderately brief; trapezoidal cell not much elongated. Præfurca of normal length. Petiole of second posterior cell less than half the length of the discal cell; fifth posterior cell much broader at base than on margin. Discal cell of medium size, fully twice as long as broad. Sixth longitudinal vein moderately approximated to the fifth; seventh longitudinal vein less than half as long as the wing. Legs slender, the femora but little stouter than the tibiæ, the middle pair, intermediate in length as in position, about three fifths the length of the wing; tibiæ scarcely longer than their respective femora, the tarsi unusually short, being only a little longer than the tibiæ. Abdomen dark above and light below.

Length of wings, 16–17.5 mm. ; of legs in the largest specimen : fore femora, 9.75 mm. ; tibiæ, 10 mm. ; tarsi, at least 11 mm. ; mid femora, 10.5 mm. ; hind femora, 11.5 mm. ; tibiæ, 11.75 mm. ; tarsi, 13 mm.

Florissant, Colorado. Two ♀ specimens ; Nos. 6062, 13075 ; besides which there is a specimen belonging to the U. S. Geological Survey, also a ♀ (No. 1482), from which the measurements of the legs were taken.

Tipula subterjacens.

Pl. 8, figs. 3, 5.

Wings about four times as long as broad, generally rather less than more than that, uncolored except for the rather faint and rather small stigma. Auxiliary vein terminating well before the middle of the inner marginal cell ; poststigmatal cross vein variable, sometimes short and transverse, at others distinctly oblique and moderately long ; trapezoidal cell rather short. Præfurca distinctly shorter than the width of the first and second basal cells at its base. Petiole of second posterior cell about half as long as the discal cell ; fifth posterior cell much broader at base than at margin. Discal cell moderate, about twice as long as broad. Sixth longitudinal vein moderately distant from the fifth. Legs slender, the tibiæ distinctly slenderer than the femora and scarcely longer than they, while the femora are rather less than two thirds as long as the wings, and the tarsi are half as long again as the tibiæ. Abdomen pale, with more or less distinct, sometimes almost wholly obliterated, dark narrow median and lateral stripes.

Length of wings, 17.5–20 mm. ; of legs in one ♀ (No. 9157) as follows : fore femora, 9? mm. ; mid femora, 10 mm. ; tibiæ, 9.75 mm. ; tarsi, 14.5 mm. ; hind femora, 11 mm. ; tibiæ, 8.5 mm. ; tarsi, 14.5 mm.

Florissant, Colorado. Described from seven specimens, one ♂, five ♀, one uncertain ; Nos. 1866, 4437, 4632, 7222, 8539 and 9157, 13737, 14972. Besides these No. 2083 and probably 2063 of the U. S. Geological Survey collection belong here.

Tipula lethæa.

Pl. 9, fig. 2.

Wings four times as long as broad, uncolored except for the small, generally distinct, triangular stigma. Auxiliary vein reaching the

middle of the inner marginal cell; poststigmatal cross vein transverse, of moderate length; trapezoidal cell not very long. Præfurca distinctly shorter than the width of the first and second basal cells next its base. Petiole of second posterior cell not half, generally not nearly half, so long as the discal cell; fifth posterior cell somewhat wider at base than at margin. Discal cell rather small, about twice as long as broad. Sixth longitudinal vein moderately distant from the fifth; seventh longitudinal vein scarcely half as long as the wing. Legs slightly less slender than usual, the tibiæ distinctly slenderer than the femora, the latter about two thirds as long as the wings, the other members not sufficiently preserved in any specimen for measurement. Abdomen pale, with dark longitudinal median and lateral stripes, the latter less distinct and all sometimes obliterated.

Length of wings, 15.5–16.5 mm; fore femora, 8.5 mm.; mid femora, 9 mm.; hind femora, 10 mm.

Florissant, Colorado. Five specimens, two ♂, three ♀; Nos. 402, 3146, 4773, 11112, 13754.

Tipula lapillescens.

Pl. 9, fig. 3.

Wings from three and a half to four times as long as broad, the stigma small, distinct, rounded, lying opposite the basal half of the discal cell, followed by a fuliginous stain in the outer half of the marginal cell, and accompanied by a slender but more or less distinct infuscation of the fifth and seventh longitudinal veins, and sometimes of all or nearly all the veins of the apical fourth of the wing; there is also sometimes a faint cloud in the middle of the basal cells. Auxiliary vein terminating a very little before the middle of the inner marginal cell; poststigmatal cross vein slightly oblique, moderately long; trapezoidal cell moderately short. Præfurca very distinctly shorter than the first and second basal cells next its base. Petiole of second posterior cell about half as long as the discal cell; fifth posterior cell considerably broader at base than at margin. Discal cell rather small, about twice as long as broad. Sixth longitudinal vein pretty closely approximated to the fifth; seventh longitudinal vein nearly or quite half as long as the wing. Legs very slender and long, the femora almost two thirds as long as the wings, the tibiæ distinctly longer than they, and the tarsi

nearly or quite two thirds as long again as the tarsi. Abdomen obscure in the specimens seen.

Length of wings, 14.5 mm. ; fore femora, 8.5 mm. ; tibiæ, 10.5 mm. ; tarsi, 16 mm. ; mid femora, 9 mm. ; tibiæ, 9.75 mm. ; tarsi, 16 mm. ; hind femora, 9 mm. ; tibiæ, 10 mm. ; tarsi, 17 mm.

Florissant, Colorado. Two specimens, one ♂, one uncertain ; Nos. 8300 and 8831, 11335.

Tipula spoliata.

Tipula spoliata Scudd., *Tert. Ins. N. A.*, 577-578, pl. 10, fig. 4 (1891).

This species forms a close link between the preceding three species of *Tipula* and the species of *Tipulidea* which follow, the *præfurca* being intermediate in length. In size, it agrees with *T. lapillescens*.

Green River, Wyoming.

TIPULIDEA (*Tipula*, nom. gen., εἶδος) gen. nov.

I venture to separate from *Tipula*, to which it is otherwise closely related, a group of species, all the members of which are smaller than the smallest true *Tipulæ*, living or fossil,* known to me, and which are peculiar for the extreme brevity of the *præfurca* ; in this respect they closely resemble *Pachyrhina*, though in the petiolate character of the second posterior cell they agree with *Tipula* and not with *Pachyrhina*. They evidently form a group intermediate between these two genera. The apical cells are slenderer than in *Tipula* ; the *præfurca* is very oblique, as in *Pachyrhina*, and is no longer, or scarcely longer than the greatest width of the first basal cell ; in consequence the inner marginal is but little if at all larger than the discal cell ; the petiole of the second posterior cell is rather short, but the cell is never sessile. It may be added that the fifth longitudinal vein is scarcely bent at the great cross vein, but is apically curved downward ; more distinctly and more uniformly than in *Tipula*, it is accompanied throughout its course by a spurious vein beneath it ; and the first longitudinal vein runs so close to the margin as to leave

* Except *T. angustata* Novák from the Egerer tertiary basin, the wing of which is only about 9 mm. long. It should also be remarked that Loew, in his too brief account of the amber Diptera, says that the species of *Tipula* entombed therein are remarkable for their small size and specifies two which are only about 7 mm. long. Perhaps they may prove to belong to *Tipulidea*.

scant space for the auxiliary vein. The legs are long and slender, with exceptionally long tarsi.

Both from their size and the brevity of the præfurca it is tolerably plain that both the unnamed species from the upper oligocene of Brunstatt, referred by Foerster (*Abhandl. Specialk. Elsass-Lothr.*, iii, pl. xiv, figs. 2, 3) to *Tipula*, are to be considered as belonging to the present genus.

Four species are known from Florissant, which may be separated by the following table :

Table of the Species of Tipulidea.

Abdomen with complete transverse bands at the apices of the segments.

The longitudinal markings of the dorsum of the abdomen mediodorsal and heavy.....*consumpta.*

The longitudinal markings of the dorsum of the abdomen subdorsal and light.....*bilineata.*

Abdomen with longitudinal markings only.

Mediodorsal stripe on abdomen heavy and broad, expanding at the apices of the segments.....*picta.*

Mediodorsal stripe on abdomen very light, often obliterated and generally slender, not apically expanded at the apices of the segments.*reliquia.*

Tipulidea consumpta.

Wings generally four times as long as broad sometimes a little less than that, in one instance (No. 11686, which may possibly not belong here) only three and a half times as long as broad, uncolored, except for the stigma. The inner marginal cell is pretty regularly fusiform, about three times as long as broad. The discal cell is also about three times as long as broad, and of just about the size of the inner marginal cell. The petiole of the second posterior cell is usually about half as long as the discal cell, but sometimes not more than one third as long, while the second posterior cell itself is about half as long as the whole of the intersected apical area of the wing, which, measuring from the end of the basal cells, is about equal to the breadth of the wing. The fifth posterior cell is considerably wider at base than just before the margin. The sixth longitudinal vein is moderately distant from the fifth. Legs very long and slender, the femora nearly three fourths as long as the wings, the tibiæ scarcely longer and a little slenderer, the tarsi two thirds as long again as the tibiæ. Abdomen rather heavily traversed by dark bands at the apices of the segments,

occupying from a fourth to a third of the length of the same, and also marked with slenderer, and sometimes not so deeply colored mediodorsal and lateral longitudinal stripes, which, especially the lateral, are apt to expand as they approach the transverse bands; there are signs on some specimens (which may be due to the nature of the surface of the stone) of a coarse and sparse punctuation on the upper surface.

Length of wings, 9.5–11 mm.; of legs in a specimen whose wing measures 10.5 mm. in length, as follows: femora, 8 mm.; tibiæ, 9 mm.; fore tarsi, 14 mm.; hind tarsi, 15 mm.

Florissant, Colorado. Eight specimens, 6 ♂, 2 ♀ (the great proportion of males is exceptional among Tipulinæ); Nos. 2117 and 7010, 11668, 11686, 13054 and 13720, 14144, 16402, 16403, 16405.

Tipulidea bilineata.

Pl. 9, fig. 8.

Wings a little less than four times as long as broad, uncolored except for the stigma. Inner marginal cell not regularly fusiform, tapering much more rapidly proximally than distally, not more than three times as long as broad. Discal cell scarcely smaller than the inner marginal cell, also about three times as long as broad. Petiole of the second posterior cell fully half as long as the discal cell, the second posterior cell itself slightly less than half as long as the whole intersected apical area of the wing, which is rather longer than the breadth of the wing; fifth posterior cell considerably wider at base than just before the margin. The sixth longitudinal vein moderately distant from the fifth. Legs very slender, the femora increasing slightly in length from the front pair backward, the middle pair about half as long again as the wings, the tibiæ slightly shorter than the femora, excepting in the fore legs where the reverse is the case, the tarsi excessively long, nearly double the length of the tibiæ. Abdomen with the hinder edges of the segments narrowly edged with fuscous and with distant, subdorsal, slender, fuscous, longitudinal lines, between which the basal segment is wholly fuscous.

Length of wings, 11–11.5 mm.; of legs in the larger specimen: fore femora, 7.25 mm.; tibiæ, 7.6 mm.; mid femora, 7.6 mm.; tibiæ, 7.25 mm.; tarsi, 14 mm.; hind femora, 8 mm.; tibiæ, 7.6 mm.

Florissant, Colorado. Two ♀ specimens, Nos. 7998, 11333.

Tipulidea picta.

Pl. 9, figs. 4, 6.

Wings nearly or quite four times as long as broad, uncolored except for the unusually distinct stigma. Inner marginal cell subfusiform, nearly or quite four times as long as broad. Discal cell considerably smaller than the inner marginal cell, from three to four times as long as broad, the petiole of the second posterior cell brief or very brief, rarely one half, usually hardly if at all more than one fourth, the length of the discal cell, the second posterior cell itself half or more than half the length of the apical intersected area of the wing, the latter about as long as the breadth of the wing; fifth posterior cell much wider at base than just before the margin. Sixth longitudinal vein moderately approximate to the fifth. Legs very slender, the femora distinctly stouter than the tibiæ, about three fifths the length of the wings, the tibiæ slightly longer than the femora, and the tarsi of great length, being nearly three fourths longer than the tibiæ. Abdomen with a heavy interrupted or sub-interrupted mediodorsal stripe, consisting on each segment of a subtriangular patch, which abruptly broadens at the posterior margin to a greater or less extent, and fails, at least distinctly, to reach the anterior margin; there is besides a slender inconspicuous lateral line on either side.

Length of wings, 10.5–13 mm.; of legs in the largest specimen: fore femora, 8 mm.; tibiæ, 8.5 mm.; tarsi, 14 mm.; mid femora, 7 mm.; tibiæ, 8 mm.; tarsi (not quite perfect), 12.5 mm.; hind femora, 7.5 mm.; tibiæ, 8.5 mm.; tarsi, 13.5 mm.

Florissant, Colorado. Fourteen specimens, 3 ♂, 9 ♀, 2 uncertain; Nos. 1040, 5368, 8192, 8205, 8386, 8598, 8826, 8850, 9000, 9129, 13708, 13745, 13749, 16421.

Tipulidea reliquiæ.

Pl. 9, fig. 5.

Wings barely four times as long as broad, uncolored except for the distinct stigma. Inner marginal cell pretty regularly subfusiform, about four times as long as broad. Discal cell somewhat smaller (not quite correctly given in the figure), about three times as long as broad. Petiole of second posterior cell generally very brief, and not one fourth the length of the discal cell, but some-

times longer and nearly or quite half its length; the second posterior cell itself generally distinctly, sometimes very considerably, more than half as long as the intersected apical area of the wing, which is fully equal to, if it does not exceed, the breadth of the wing; fifth posterior cell considerably broader at base than just before the margin. Sixth longitudinal vein rather closely approximated to the fifth. Legs very slender, the femora stouter and slightly shorter than the tibiæ, three fourths as long as the wings, and the tarsi, or at least the hind pair, nearly three fourths as long again as the tibiæ. Abdomen light colored, with feeble markings, consisting of feeble and simple, generally rather narrow, mediodorsal and lateral dusky stripes.

Length of wings, 10-13.5 mm.; of legs in a ♀ having wings 13 mm. long, as follows: fore femora, 7 mm.; tibiæ, 7.75 mm.; tarsi (probably incomplete), 10 mm.; mid femora, 7.5 mm.; tibiæ, 8 mm.; tarsi (perhaps incomplete), 12.5 mm.; hind femora, 7.5 mm.; tibiæ, 8.5 mm.; tarsi, 14 mm.

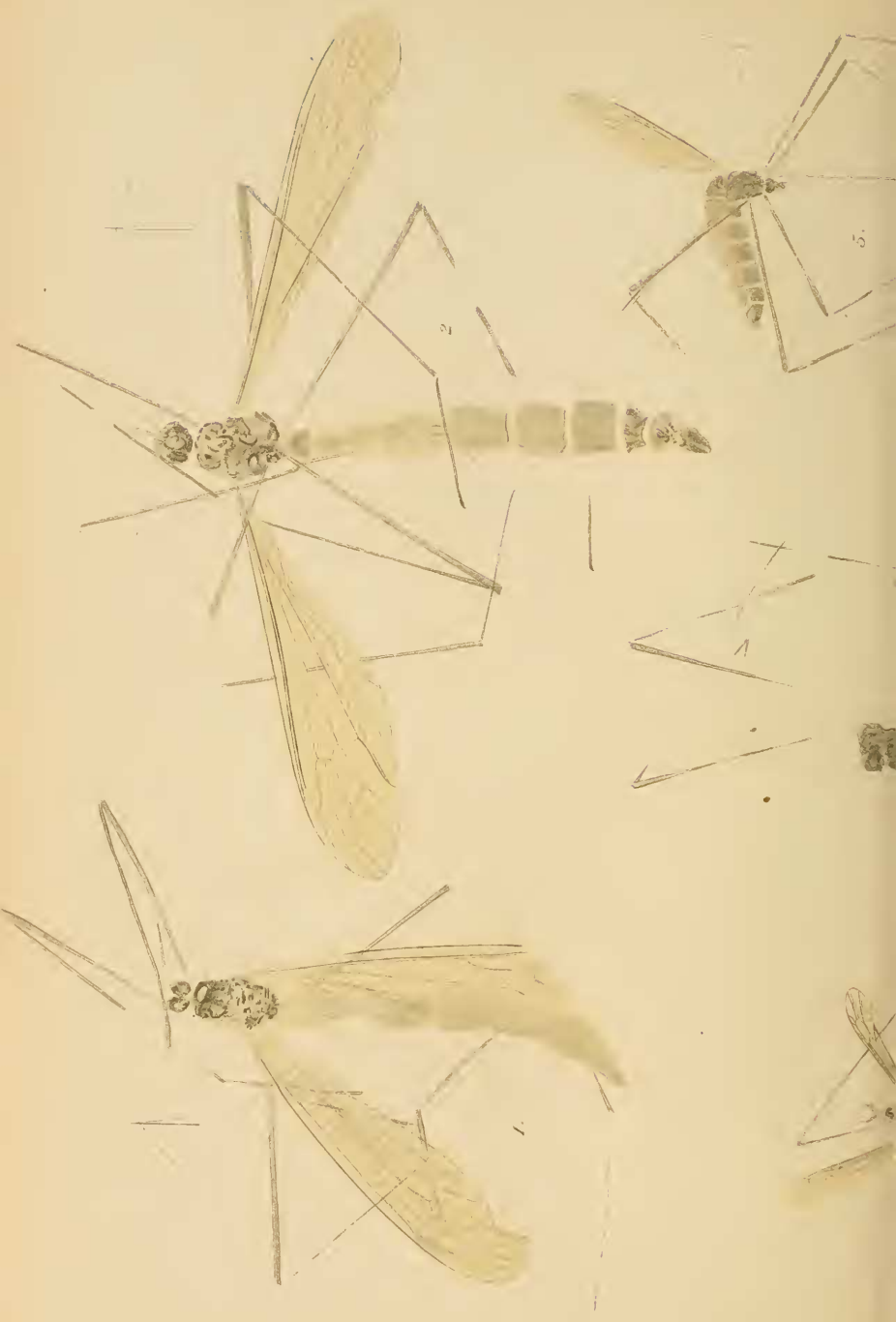
Florissant, Colorado. Eight specimens, 5 ♂, 3 ♀; Nos. 4732, 8066, 8385, 8480, 8869, 10105, 11841, 14145.

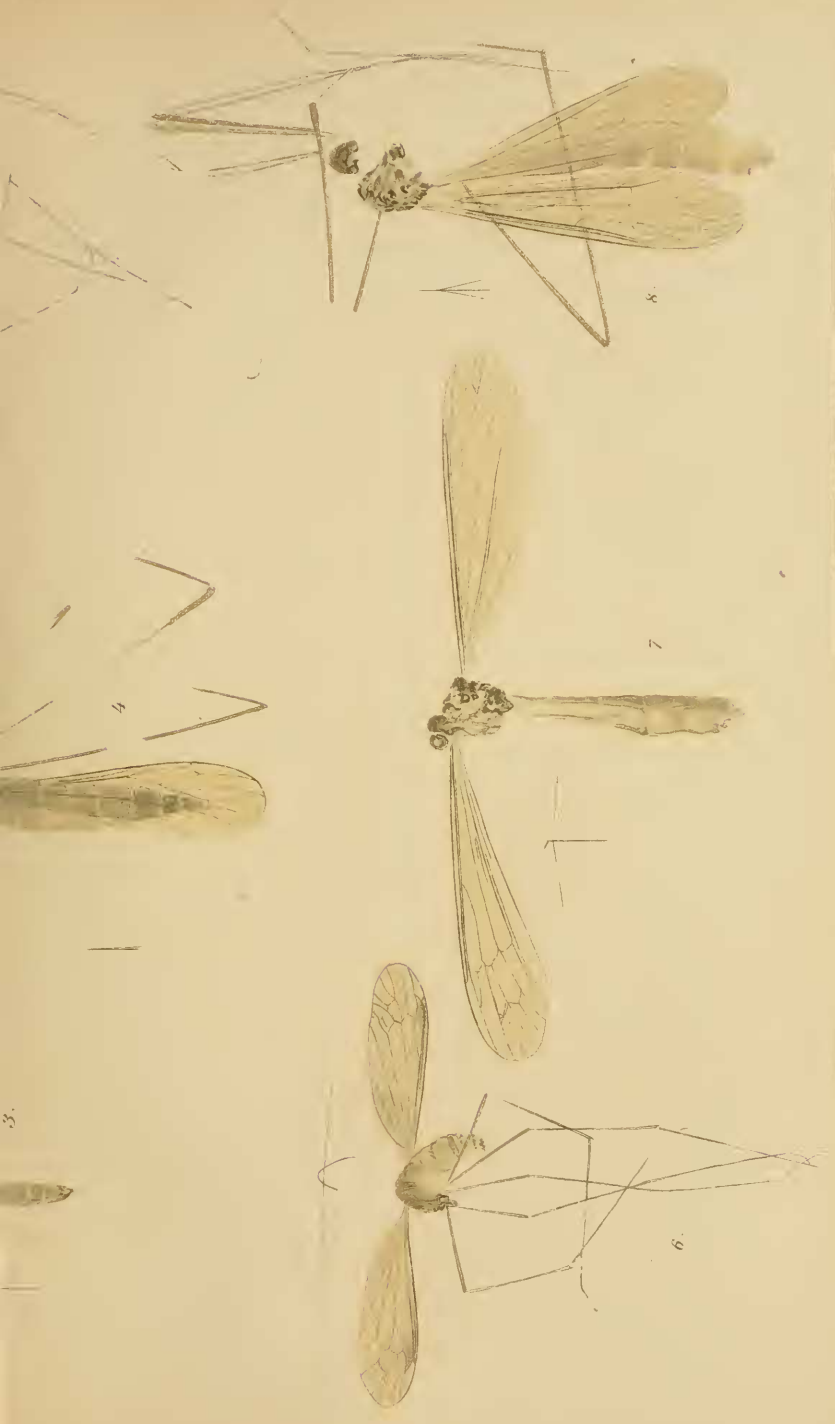
MICRAPSYS (*μικρὸς, ἀψίς*) gen. nov.

This genus differs strikingly from *Tipula* in the character of the discal cell, which is somewhat remarkable; not only is it of exceedingly small size, but it is entirely removed from the fifth posterior cell, the forking of the fourth longitudinal vein not taking place where the great cross vein unites with the final branch of the fourth longitudinal vein, but at the inner inferior base of the discal cell, which thus becomes quadrilateral and is separated from the anterior basal angle of the fifth posterior cell by the width of the fourth posterior cell.

The genus is evidently allied to *Tipulidea* by the brevity and obliquity of the præfurca, and should directly follow it. In the lack of contact of the discal cell with the fifth posterior cell it is like *Megistocera*, but it differs from that in all the other characters by which *Tipula* is distinguished from *Megistocera*, and does not indeed belong to the *Dolichopezini* to which *Megistocera* is referred.

A single species is known, unfortunately represented only by a single imperfect specimen.





TERTIARY TIPULIDE OF COLORADO.